

A Revision of Indian Viscaceae

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Abstract

The family Viscaceae in India with 19 species under *Arceuthobium* M. Bieb., *Ginalloa* Korth., *Korthalsella* Van Tiegh. and *Viscum* L. is taxonomically revised based on herbarium studies, explorations and collections from different parts of India. *Viscum* is represented by 15 species. Among them, 4 species, including the recently described *V. malurianum* Sanjai & N.P. Balakr. and *V. subracemosum* Sanjai & N.P. Balakr., are endemic to India. *Viscum articulatum* var. *thelocarpum* and var. *liquidambaricolum* are merged with *V. articulatum*. *Viscum album* var. *meridianum* is sunk under *V. album* proper. *V. orbiculatum* and *V. verruculosum* are treated as synonyms of *V. heyneanum*. *Viscum acaciae* Danser is a new record for India. *Viscum mysorense* is considered as a link between the leafy and leafless species. *Korthalsella* is represented by a single species, *K. japonica* (Thunb.) Engler, as *Korthalsella japonica* var. *coralloides* is merged with *K. japonica* proper. *Ginalloa andamanica* Kurz is endemic to South Andamans. Systematic position, factors affecting distribution, morphology, hyperparasitism and cryptic mimicry of/in Viscaceae are discussed.

Keywords: Viscaceae, India, Four genera, 19 species

Introduction

Viscaceae, previously treated as part of the mistletoe family Loranthaceae, consists of hemiparasites, mostly distributed in tropical and warm temperate regions. The family is represented by seven genera and about 400 species (Barlow, 1997).

J. D. Hooker (1886) in *Flora of British India* described 12 species among 3 genera under the present Viscaceae from within the present political boundary of India. Later, one genus and several species have been described from the country (Danser, 1941; R.S. Rao, 1957). After Hooker, Gamble (1925), T. Cooke (1901-08), Duthie (1903-22), Prain (1903) and Haines (1921-25) studied the family. Danser (1941) revised the British Indian species of *Viscum* and R. S. Rao (1957) revised its Indo-Malayan species. Apart from these, there is no other major taxonomic work on Indian Viscaceae.

The members of Viscaceae cause extensive damage to fruit trees and forest trees (Therkommedahl & Williams, 1983). Recently, the family has triggered some curiosity as some members like *Viscum album* L. were found useful as cure for cancer and tumour (Adler, 1997; Basaran *et al.*, 1997; Gholap, 1998).

Some biochemical studies dealing with secondary metabolites have also come up (Rikovski & Basiric, 1949; Plouvier, 1953; Richter & Popp, 1987). We do not have sufficient basic knowledge on delimitation and identity of various members of such an important family. An in-depth revision of Indian Viscaceae was done in this context.

The family is named after the type genus *Viscum* L. The name *Viscum* comes from the viscous nature of their fruits. The European mistletoe, *Viscum album* L., is the type of this genus. Members of the family are easily distinguished in field by their semiparasitic habit, small unisexual flowers arranged in units of small cymes (triads) often grouped in homogeneous or heterogeneous racemes or spikes and viscous small globose or ovoid berries or drupaceous fruits. Out of the 4 genera in India, *Viscum* has the largest representation with 15 species. The plants of this genus have a tendency towards hyperparasitism. *Arceuthobium*, commonly called the dwarf mistletoe, was previously included in *Viscum*. Members of this genus have restricted host range, mostly the coniferous trees. They cause extensive damage to coniferous forests

(Hawksworth, 1977; Hawksworth & Geils, 1990; Parker & Riches, 1993). *Korthalsella*, named after the Dutch botanist Pieter Willem Korthals, another genus of the family, was also previously included in *Viscum*. These are high altitude plants found mostly on Rhododendrons. *Ginalloa* is the fourth genus represented in India by *G. andamanica*, an endemic species of doubtful distinction. J.D. Hooker who could not see a specimen based his descriptions solely on the protologue given by Kurz.

Systematic position

Miers (1851) was the first to treat Viscaceae as a family distinct from Lorantheae. He was of the opinion that while there were several characters distinguishing the two families, the only characters of resemblance between them are the position of stamens, mode of development of seeds, their glutinous properties and the semiparasitic habit.

Linnaeus (1753) in his *Species Plantarum* placed *Viscum* under the group Dioecia Tetrandria. Humboldt *et al.* (1818) did not distinguish Viscaceae, and *Viscum* and its allies were not given any special status under Lorantheae. Roxburgh (1832), following Linnaeus, placed *Viscum* under the group Dioecia Tetrandria. Wight and Arnott (1834) included Viscaceae in Lorantheae. Likewise, Griffith (1854) also considered it as part of Lorantheae, though he observed that *Loranthus* and its allies possessed corolla while *Viscum* and its allies did not.

Bentham and Hooker (1883) elevated it to a tribe Viscaceae of Lorantheae under the order Achlamydoxyporeae in Monochlamydeae. Van Tieghem (1896 a), while treating Viscaceae as a family, separated it from Lorantheae and elevated its status to the order Viscaceae under the subclass Lorantheae. The order comprised the solitary family Viscaceae with subfamilies Arceuthobideae, Ginalloideae and Viscideae. Engler and Prantl (1897) placed *Viscum* in a subfamily Viscoideae under Lorantheae. They divided Viscoideae into four tribes: Eremolepideae, Phoradendreae, Arceuthobieae and Viscaceae. Bessey (1915) included it in Lorantheae under the order Celastrales. Hutchinson (1926) did not see any reason to separate it from Lorantheae and placed it in the order Santalales, Division Lignosae, subphylum Dicotyledonae. Danser (1933), following Engler and Prantl, treated it as a subfamily, Viscoideae of Lorantheae though in an earlier publication, he (1929) stated that he did not see any necessity to treat

the subfamily Viscoideae as a separate family. According to Gunderson (1950), it comes under Lorantheae of the order Santalales. Rendle (1956) considered it as a subfamily of Lorantheae in the order Santalales under Monochlamydeae. Maheshwari (1954, 1958) based on their embryological characters, treated Viscaceae as a family distinct from Lorantheae. Johri and Bhatnagar (1960), Barlow (1964) and Kujit (1969) held the same view.

Thorne (1968) distinguished it as a family under the order Santalales in the super order Santaliflorae of subclass Dicotyledonae. Lawrence (1951) considered it as a subfamily under Lorantheae. Takhtajan (1969) did not separate it from Lorantheae which he placed in the order Santalales, super order Celastrinae, subclass Rosidae of the class Magnoliophyta. Though Cronquist (1970) did not distinguish Viscaceae as a separate family, Samuel and Singer (1979) mentioned that Cronquist had the intention to treat Viscaceae as a distinct family under the Santalales, subclass Rosidae of the Class Magnoliopsida of Division Magnoliophyta. Wiens (1987) treated Viscaceae as a separate family. Blanche and Parvathi (1996) studied chemotaxonomy of some members of the Lorantheae and Viscaceae and their results substantiated the separation of Viscaceae from Lorantheae.

Thus, there are wide differences of opinion regarding the status of the family Viscaceae. Since there are several valid reasons for separating it as a family distinct from Lorantheae by morphological as well as embryological characters, we treat here Viscaceae as a family distinct from Lorantheae.

Factors affecting distribution

Several factors affect the growth of Viscacean members.

I. Physical factors: There can be slight variations in requirement of light intensity among various members of Viscaceae. Their affinity towards high tree tops, open stands or edges of dense forests show their preference to light. However, the genus *Arceuthobium* is found growing well even on lower branches of host plants where sunlight is poor.

Altitude appears to restrict distribution of Viscaceae members in certain areas. *A. minutissimum* is found only in upper dry cold ranges of the Himalayas where its host *Pinus excelsa* is found. The frequency and abundance of *Arceuthobium* species in relation to

steepness of slopes have been provided in the studies of Korstian and Long (1922), Roth (1954) and Hawksworth (1959). According to them, the abundance of this species increases with steepness and altitude.

The dry humid atmosphere existing in rain shadow localities of Deccan plateau might have played a key role in restricting the distribution of *Viscum heyneanum* to the west coast and the Western Ghats up to 2000 m. It was observed that the leafless *V. articulatum* was distributed in the plains throughout the country but the leafy species were found mostly on hills at altitudes between 250 and 1800 m.

Biotic factors: *Viscum* is found on a number of hosts, whereas *Korthalsella* has a restricted host range. *Arceuthobium* occurs only on conifers. A species of *Arceuthobium* may have a specific host, though it may occur less commonly on a few other selected hosts (Kujit, 1955). There are also situations where a species of *Arceuthobium* can parasitise even laticiferous angiosperms (Hawksworth & Peterson, 1959; Kujit, 1956; Horwood, 1983). A large part of this plant occurs inside the host tissue as branching runners. In case of *A. minutissimum*, the stem is of a single internode of about 5 mm length and this portion alone is visible outside.

Mistletoe birds (Dicaeidae) play a key role in pollination and dissemination of seeds in Viscaceae. Sun birds (*Nectariniidae*) are important pollinators in the tropics (Salim Ali, 1932). In Europe, the mistletoe thrushes (*Turdus viscivorus*) are the principal vector of *Viscum album*. These birds migrate from Africa to Europe in late winter (January to March) and during this period feed almost exclusively on mistletoe berries. They utilize only a portion of the pulp and eliminate seeds in viable condition. It is believed that their migration paths positively influenced the abundance of mistletoe in Europe.

The shoots of *Arceuthobium* which often girdle the infected conifer stems are eaten by porcupines. This destroys the parasites to some extent (Taylor, 1935). Some insects facilitate propagation of mistletoes acting as pollinators; others are limiting agents as they destroy the aerial shoots (Tubeuuf, 1923). Tubeuuf (1923) discussed some fungi like *Shaenopsis visci* growing on *Viscum album*. A leaf spot caused by it is found damaging this species. Fungi which cause extensive damage to mistletoes (*Herpotrichia juniperi*, *Sphaeria arceuthobii* and *Caliciopsis arceuthobii*) have been reported from countries like Canada, United States and Mexico (Hawksworth & Weins, 1996).

Morphology

a. **Habit:** Viscaceae members are hemiparasites but *Arceuthobium minutissimum* Hook. f. is a parasite growing endophytically within the host and is devoid of chlorophyll. While some members could be minute and microscopic, others could grow to a height of about one meter. The smallest member of the family is *A. minutissimum*.

b. **Stems:** Stem of Viscaceae provides significant characters for identification. In *Viscum*, it is highly variable: terete in *V. orientale* and *V. ramosissimum*, terete and longitudinally grooved in *V. heyneanum*, variously quadrangular in *V. angulatum* and longitudinally flattened in *V. articulatum*. It is longitudinally flattened in *Korthalsella* but the flattening is only in one plane. The stem is not visible in *Arceuthobium minutissimum* as it is a much ramified endophytic structure inside the host. It is short and terete in *A. oxycedri*; *Ginalloa* has also terete stem. Nodal region in all members is found a little swollen. The branching pattern varies from dichotomy and trichotomy to umbellate condition.

c. **Leaves:** Viscaceae members may have leaves or may not. This plays an important role in identification. Lushington (1902) has provided a key for identification of Loranthaceae (*sensu lato*) using leaf characteristics. *Korthalsella* and *Arceuthobium* are leafless. Leaves are present in *Ginalloa*. *Viscum articulatum*, *V. angulatum*, *V. ramosissimum* and *V. malurianum* are leafless. Leaves are rarely present in *V. ramosissimum*. *V. mysorensense* possesses only a few leaves.

d. **Inflorescences:** Inflorescences are highly modified in Viscaceae. *Viscum* possesses only cymose inflorescences arising from nodes. Number of cymes at each node may vary from species to species. Cymes may be bisexual or unisexual. Sometimes up to five flowers are found on a single cyme. In bisexual inflorescences, the central flower may be female as in *V. orientale* and *V. acaciae* or male as in *V. capitellatum* and *V. trilobatum* Talbot. In *V. monoicum*, the central flower of the triad is usually male; sometimes, it is absent. In *V. subracemosum*, cymes get enlarged by the development of an adventitious cyme in the long axis and are subracemose. *V. album* is dioecious. Further, the central flower of the cyme has an individual bract. Individual bracts are also noticed in *V. articulatum*. In *V. malurianum*, flowers are borne in triads with 2 bracts for each. *Arceuthobium* is also dioecious. Only the flowers are seen projected above the host tissue in *A. minutissimum*. Inflorescence bears male and female flowers in

Korthalsella. It starts with a single axillary flower but later it develops into a group of flowers with the sprouting of adventitious and collateral serial buds. Inflorescences are axillary or terminal, sessile and spicately arranged, dichasial cymes in *Ginalloa*. The central flower of the dichasium is female and the lateral ones are male.

e. **Bracts:** Bracts enclose inflorescences or individual flowers. Sometimes we could observe presence of both the situations in a single inflorescence. Bracts could arise from the base of peduncle or the top. Bracts possess calcareous thickening along the margins. In most cases bracts are found united, at least basally, if not wholly to form a navicular structure enclosing the inflorescence or flower. Often they are persistent and could be seen along with fruits forming a saucer shaped protective structure at the base.

f. **Fruits:** Fruits are usually drupes, each with a solitary seed enclosed within the sweet viscous pulp. Sahni (1933) termed the fruits as false fruits because the fruit cover is the enlarged thalamus which encloses the ovary.

Dispersal

Members of *Viscum* make use of birds for the dispersal. Attracted by the sweet pulp of the fruits, birds either feed on it and disperse the seed unaffected through the excretion at a distant place or accidentally the sticky seeds get attached to the body of the birds and get dispersed. They get attached to the surfaces of host plants and under favourable environmental conditions, germinate giving rise to new plants (K. N. Rao, 1967). According to Sahni (1933) seeds have to undergo a pretreatment in the alimentary canal of birds for germination. *Korthalsella* and *Arceuthobium* forcefully discharge their seeds. In *Ginalloa andamanica*, the mechanism of dispersal is unknown.

Hyperparasitism

Hyperparasitism – parasitisation of an established parasite on another plant of the same or different species – is observed in many members of Indian Viscaceae. Burkill (1906) reported *Viscum articulatum* parasitic on *Loranthus vestitus* which in turn was parasitic on *Quercus incana*. *Loranthus exocarpi* was found growing on *Loranthus pendulus* and *Loranthus quandang*. Sanjai and Balakrishnan (2001a) reported *Viscum capitellatum* and *Viscum trilobatum* showing strong preference to grow on *Loranthus longiflorus* var.

falcatus (= *Dendrophthoe falcata*). *Viscum loranthei*, likewise, is found to parasitise on *Taxillus* species. This is found only in the western Himalaya. Though rare, *Viscum orientale* is found as a parasite on *Macrosolen* species. Hyperparasitism exhibited by these species may be considered as a step towards complete parasitisation. Lack of good conducting system may be the reason behind the phenomenon of hyperparasitism.

Cryptic mimicry

The term cryptic mimicry according to Wickler (1968) is restricted to situations where a potential prey species deceives a predator by providing false signals of unpalatability. He observed that cryptic or camouflaged species avoid predation by giving no signals.

It seems that host specificity plays a key role in cryptic mimicry. Sanjai and Balakrishnan (2001b) observed that when a parasite was found on host other than its normal or more specific host, the incidence of cryptic mimicry was not observed. In Indian Viscaceae, it is found that the parasite tries to mimic vegetative characters of host, mainly stems and occasionally colour and shape of leaves. *V. angulatum*, when found on its common host *Olea dioica*, is leafless and generally possesses green colour. At times it develops brownish colour and resembles a leafless twig of the host. The leafless branches are commonly noticed on the host also.

The new species *V. malurianum* was collected from the host tree *Ficus benghalensis*. From a distance the parasite looks just like the hanging aerial roots of the host. *V. subracemosum* usually found on *Pongamia glabra* depicts the leaf colour of the host. It is very difficult to distinguish the parasite from the dense foliage of the host. *V. trilobatum*, usually found as a hyperparasite on Lorantheaceous members, also shows cryptic mimicry. Some of its older branches are leafless and appear as a branch of young shoots of the host (specifically on *Dendrophthoe falcata*). Similarly, the hyperparasite *V. capitellatum* when found on the same host appears as a young inflorescence of the host.

Arceuthobium minutissimum found on *Pinus wallichiana* appears as brown pustules. This resembles the scale leaves of the host or projections of the bark. *A. oxycedri* growing on *Juniperus* species appears as a small branch of the host, though distinguishable by its distinct colour. *V. acaciae* collected from sandalwood tree mimics the host in having linear-lanceolate leaves. The colour of branches and leaves

and branching patterns were also similar to those of the host. *V. loranthi* found on *Taxillus* species appears as a leafless branch of the host.

As there are little predators for the family Viscaceae, the reason behind the phenomenon of cryptic mimicry may probably be to derive advantages from the pollinating and seed dispersing agents of the host.

Conclusion

Viscaceae members are exclusively semi-stem-parasites and this character distinguishes the family from Loranthaceae which accommodates root parasites like *Nuytsia*. A gradual reduction in morphological characters that mark advanced feature is noticed in Viscaceae. Members do not have external runners to spread on host, which is a salient feature in Loranthaceae. They use internal, endophytically growing structures as runners that give rise to vegetative buds at intervals.

Among the Indian members, a reduction in leaf structure is evident. Leaves are fully developed in *Ginalloa andamanica* but are absent in *Arceuthobium* and *Korthalsella*. *Viscum* has both leafy and leafless species. Similarly, we see a gradual reduction in size from shrubby habit of *Ginalloa andamanica* to the microscopic nature of *Arceuthobium minutissimum*.

Much variation has been noticed in size of inflorescences. Long spike of triads are found in *Ginalloa andamanica* but in *Arceuthobium* it is reduced to a cluster of unisexual flowers borne on an individual of either sex. In *Viscum subracemosum*, cymes and sometimes dichasia are found. *Ginalloa*, *Korthalsella* and *Viscum* (except *V. album*) are monoecious, whereas *Arceuthobium* is dioecious. Sometimes adventitious cymes develop laterally from the initial triad as in *V. angulatum*, which often encircle the whole node as in *V. loranthi* and *V. malurianum*. In a monoecious plant, the central flower of the floral triad may be male or female. Sometimes, all male and female inflorescences are also seen as in *V. heyneanum*.

Viscaceae

Viscaceae Miers in Ann. & Mag. Nat. Hist. Ser. 2, 8: 179. 1851; Miq., Fl. Ind. Bat. 1, 1(5): 803. 1856; Van Tiegh. in Bull. Soc. Bot. France 43: 247. 1896. *Loranthaceae* subfamily *Viscoideae* Engler in Engler & Krause Pflanzenfam. 16b: 182-203. 1935. Barlow in Proc. Linn. Soc. N.W. Wales 89: 269. 1964; Kujit in Brittonia 20: 138. 1969.

Type genus: *Viscum* L.

Shrubs or herbs, perennial, evergreen, parasitic on aerial parts of the host plants, attachment by a single primary haustorium, pubescent or glabrous, monoecious or dioecious; stems usually forked, brittle, much branched with usually swollen and articulated nodes; internodes terete, often angular or flattened, especially in species without developed leaves, usually green. *Leaves* present or absent, opposite, single, entire, evergreen or sometimes reduced to scales; stipules absent. *Inflorescences* axillary or terminal, unit of the inflorescence a cyme, solitary or sometimes aggregated to form racemose or spicate compound inflorescences or condensed to dense clusters. *Flowers* minute, unisexual, actinomorphic, monochlamydous; perianth lobes 2 - 4, valvate, persistent in fruits; stamens as many as or less than the number of perianth lobes, opposite and adnate to the inner surface of perianth lobes or free; anthers basifixed or sometimes united into a synandrium, 1- to many loculed, opening by pores or slits; pollen spherical; ovary inferior, unilocular, with a short placental column; ovules not distinct, sporogenous cells located at the base of the placental column; style short, sometimes conical; stigma simple, subsessile, capitate or nipple-shaped. *Fruits* berry-like, one-seeded, covered by a sticky layer; seeds solitary in each fruit, with endosperm.

Distribution: The family comprises of seven genera and about 400 species, predominantly of tropical distribution with a few species in temperate regions. In India, four genera and 19 species are found. Some species are widely distributed but many are localized in distribution, especially in the southern peninsula of India.

Key to genera

- 1a. Internodes flattened in one plane, leafless, up to 20 cm long; inflorescence pubescent; anthers united into a single unit.....**Korthalsella**
- 1b. Internodes flattened in different planes, terete or angular, leafy or leafless; inflorescence glabrous; anthers not united into a single unit**2**
- 2a. Mature plants always less than 8 cm long, leafless, dioecious **Arceuthobium**
- 2b. Mature plants always more than 8 cm long, leafy or leafless, monoecious or dioecious**3**
- 3a. Internodes with sheathing cataphylls above

each node, not twisted above each node; inflorescence a spike of 3-flowered cymes; anthers with filaments free from perianth lobes, opening by slits **Ginalloa**

- 3b. Internodes without cataphylls above each node, twisted 90° just above the node; inflorescences cymose or subracemose, 3- to 5-flowered; anthers sessile, attached to the perianth lobes, opening by pores **Viscum**

Arceuthobium M. Bieb.

Arceuthobium M. Bieb., Fl. Taur. Cauc. 3(4) Suppl: 629. 1819, *nom. cons.*; Engler & Krause in Engler, Pflanzenfam. 16b: 182-203. 1935.

Type species: *A. oxycedri* (DC.) M. Bieb.

Small herbs or shrubs, dioecious, semi-parasitic on stems (sometimes endophytic), 0.5 cm to 7 cm long, glabrous, variously coloured from greenish yellow to orange, reddish or black, tufted, branches jointed, terete or slightly angular, compressed. *Leaves* absent or reduced to minute opposite and connate scales. *Flowers* coloured, generally decussate or rarely whorled in young shoots, 2-4 mm across, monochlamydous. *Male flowers* sessile with a central nectary; perianth with 3 or 4 segments (rarely up to 7), free; stamens equal to perianth lobes; filaments absent; anthers opposite to and adnate to each perianth segment, spreading, circular, uniloculate, dehiscing by a slit; female flowers pedicellate; perianth with 2 segments adnate to the ovary, persistent; ovary inferior, ovate, compressed; style single, short; stigma round or capitate; ovules not distinct. *Fruits* ovoid, berry, 1-seeded, mucilaginous, bi-coloured (distal and basal portions of different shades), explosive at maturity; seeds without true integuments, usually 3-5 mm long, ovoid to lanceolate, containing one (rarely 2) distal, cylindrical embryo with copious endosperm.

Distribution: Forty two species are distributed mostly in the United States and Mexico. In Old World, 8 species occur and two species are found in India. *Arceuthobium* holds the unique distinction of having representations in both Old and New Worlds.

Host range: Species of *Arceuthobium* are specific parasites on conifers and not reported from any other plant species. The genus exhibits a very narrow host range. Some species are restricted to a single host species. Usually there are one to several major hosts within a single host genus. Parker and Riches (1993) have noticed secondary hosts when they are growing

in association with a heavily infested primary host. It is observed that poor soil conditions and stem growth rate of the host favour *Arceuthobium*.

Note: This genus is a dominant parasite of the coniferous forests. A substantial area of forests in North America is infested with this genus leading to serious loss in timber volume and quality (Parker & Riches, 1993). A 6-point rating system for defining the *Arceuthobium* infestation of individual trees has been developed by Hawksworth (1977) and Hawksworth and Geils (1990). With a rating of six for this genus, almost 100% of ponderosa pines of less than 23 cm in diameter are expected to die within a few years.

Key to species

- 1a. Plants always visible for less than 3 mm outside the host body, endophytically growing, appearing only as brown pustules on the surface of host **A. minutissimum**
- 1b. Plants always visible for more than 5 mm outside the host body and well branched **A. oxycedri**

Arceuthobium minutissimum Hook. f., Fl. Brit. India 5: 227. 1886. **Figs 1a,b**

Type: Kumaon Himalaya, 3250 m, 1884, Duthie s. n. (K-n. v.).

Dioecious, minute, stem-parasites without any visible stem, appearing as green or brown pustules on the bark of the host, the inconspicuous stem ramifying inside bark tissue rarely projecting above the surface for only up to 3 mm long; staminate plants yellow green; pistillate plants greenish, usually about twice as long as the staminate plants, primary branches many, arising from basal cups but without secondary branching, joints up to 2 mm long; sheaths minute, 2-toothed. Basal portions of the dominant shoots c. 1 mm in diameter; third internode 0.5-1.4 mm long, 0.3 -1 mm wide; flower branches piercing the epidermis of host and appearing as minute 2-lipped cups. *Male flowers* sessile in cup, 2-2.5 mm across; perianth mostly (3-) 4 (-5)-merous, free, lobes c. 0.8 x 0.8 mm; anthers 0.4-0.5 mm across. *Female flowers* pedicellate, perianth slightly bifid. *Fruit* borne on minute branches composed of 2 joints, a berry, 2-2.5 x 1-1.5 mm, with persistent perianth on its tip.

Flowering & Fruiting: June-October.

Distribution: The Himalayas. According to Bagchee (1952) it is usually found in dry regions of the

Himalayas (Upper and Lower Bashahr and Kulu in Himachal Pradesh, Kashmir).

Hosts: Pinus wallichiana A.B. Jacks, *Abies pindrow* (Royle ex D. Don) Royle and *Cedrus deodara* (Roxb.) G. Don

1805.

Fig. 1c

Type: Unknown but Komarov (1936) states it is at P.

Dioecious, semi-parasites, small, tufted, evergreen, glabrous up to 10 cm high, usually verticillately branched; branches jointed; basal shoots 1-4 mm

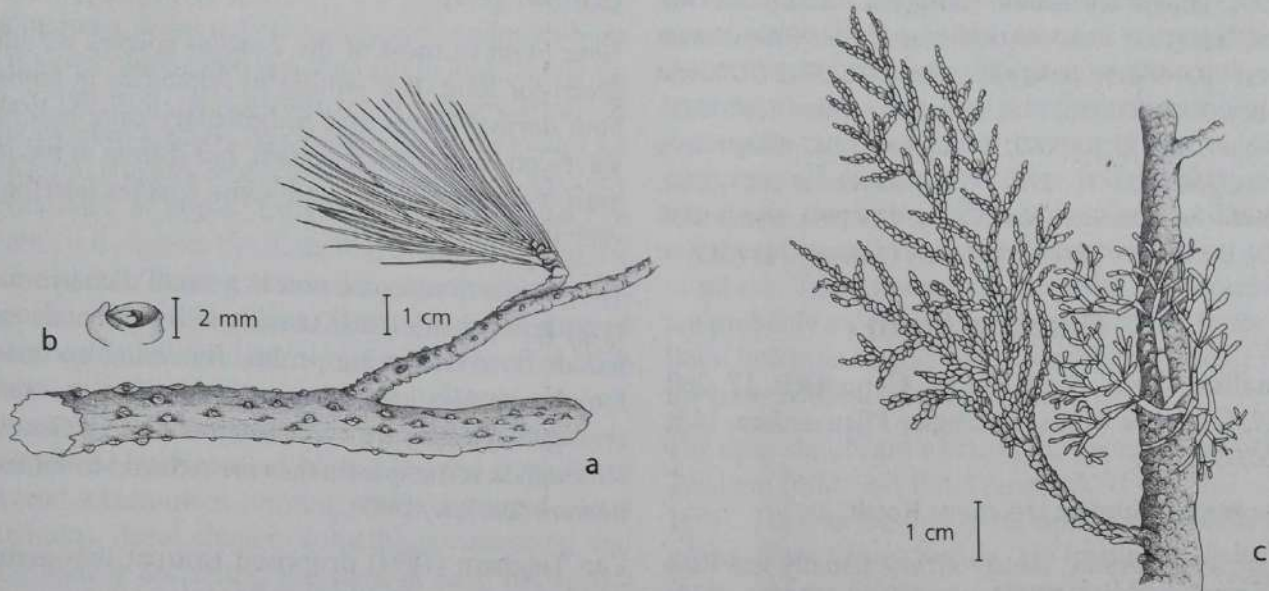


Figure 1. *Arceuthobium minutissimum* Hook. f. – a. Habit, b. Flower, enlarged view; *Arceuthobium oxycedri* (DC.) M. Bieb. – c. Habit.

Notes: J. D. Hooker, while describing this plant, mentioned that it was the minutest plant that he could recollect. *Pinus wallichiana* is the principal host of this plant. This plant causes considerable damage by killing the top of the blue pine saplings of about 1.8 meter in height. It is also observed that the plant is parasitic on younger parts, may be due to its difficulty in penetrating thick bark of older parts.

Specimens Examined: **Himachal Pradesh**, Baspa Valley, 3425 m, 26.5.1972, Janardhanan 47486 (BSD); Mastrang, 19.8.1973, Janardhanan 52791 (BSD); Purbami hillslope, 2533 m, Janardhanan 46538 (BSD); Chikkul, 16.8.1973, Janardhanan 52734 (BSD); Chamoli, Nitic Village, 3800 m, 9.9.1975, Naithani 56138 (BSD). **Jammu & Kashmir**, Kashmir, Bhadrovah, 2000 m, 29.5.1959, T.A. Rao 9065 (CAL); Pahalgaoon, 8000 ft., June 1905, Meebold 4070 (CAL); Sind Valley, 8000-9000 ft., 26.6.1892, Duthie 11481 (CAL); Sumbiali, 10,000-11,000 ft., 22.5.1892, Duthie 11204 (CAL); Kaimmulhiddar Valley, 10000-11000 ft., 21.7.1893, Duthie 14181 (CAL). **Uttaranchal**, Nabikali river side, 12.9.1900, collector's name illegible, 24933 (CAL); Pauri, 2400 m, 4.10.1971, Janardhanan 46463 (BSD).

Arceuthobium oxycedri (DC.) M. Bieb., Fl. Taur. Cauc. Suppl. 3(4): 629. 1819; Parker, Fl. Pl. Punjab 440. 1918; Naithani in Fl. Pl. India, Nepal & Bhutan 370. 1990. *Viscum oxycedri* DC., Fl. Franc. (ed. 3) 4: 274.

across; internodes terete, c. 5-9x1 mm, often markedly wider at top than at base. *Leaves* reduced to triangular connate scales forming a small cup-like sheath at nodes. *Male flowers* sessile, 1.5-2.5 mm across; perianth mostly 3-merous, occasionally 4-merous and rarely 2-merous; anthers unilocular, opening by an aperture. *Female flowers* pedicellate, 1 or 2 together, usually 3-partite; ovary inferior; style short; stigma minute. *Fruit* a berry, ovoid, mature fruit c. 3x1.5-2 mm.

Chromosome number: n=13-17 (Pisek, 1924).

Flowering & Fruiting: June to September.

Distribution: Old as well as New World; widely distributed in the Himalays (Uttaranchal, Himachal Pradesh and Jammu Kashmir).

Hosts: *Juniperus oxycedrina* St.-Leg., *J. excelsa* M. Bieb., *J. macropoda* Boiss., *Cupressus macrocarpa* Hartw. ex Gordon.

Note: It is a medicinally important plant having properties more or less similar to that of *Viscum album*. *Arceuthobium oxycedri* is closely related to *A. azoricum* and *A. juniperi-procerae* (Hawksworth & Wiens, 1975) but differs in its deep green colour, higher frequency of whorled branching, elongated internodes and more glaucous fruits.

This species is reported to be damaging Juniper forests in many areas. Jamal and Beg (1974) reported 50% tree mortality on *Juniperus macrocarpa*.

Specimens Examined: **Himachal Pradesh**, Pooli hill slope, 2837 m, 7.6.1972, Janardhanan 47787 (BSD); Pooli hill slope, above PWD guest house, 2837 m, 7.6.1972, Janardhanan 47786 (BSD). **Jammu & Kashmir**, Pahalgam, 7200 ft., 19.8.1969, Vaid 7148 (DD); 19.8.1969, Keshavanand 7148 (DD); Koram forest, 7000-8000 ft., 20.8.1906, Keshavanand 457 (DD); Jhelam Valley, 7000-9000 ft., 11.8.1908, Keshavanand 1065 (DD); Kashmir, 8000 ft., 8.9.1893, Keshavanand 14182 (DD); Narva forest, 7500-8000 ft., 29.6.1908, Keshavanand 1023 (DD). **Uttaranchal**, Kumaon, Kali Valley, 14.9.1884, Duthie 3359 (DD); Garhwal, 10,500 ft., 18.7.1916, Osmaston 743 (DD).

Ginalloa Korth.

Ginalloa Korth., Verh. Batav. Genootsch. 17: 260. 1839; Engler & Krause in Engler Pflanzenfam. 16 b: 182-203. 1935.

Type species: *Ginalloa arnottiana* Korth.

Aerial, semi-parasitic, slender shrubs, usually less than 1 m high, monoecious, glabrous; stems dichotomously or trichotomously branched, striate or longitudinally grooved with terete slender internodes, bearing a sheath-like thickening (cataphylls) above each node. *Leaves* normally developed, entire, opposite, unifacial, curvined, often with 1-5 elongated veins, usually visible on both surfaces; rudimentary leaves forming a boat shaped collar encircling the stem. *Inflorescences* terminal and axillary, sessile spikes of decussate pairs of cymes (triads) subtended by subcupular involucre. *Flowers* unisexual, 3-merous, sessile, the central flower of the triad usually female and the laterals male; bracts small, in pairs, bracts of each pair of opposite cymes united to form a cupular rim; bracteoles of the lateral flowers subtending each cymule, small, free, entire to densely fimbriate. *Male flowers* globose or slightly flattened, 0.5-1 mm long; perianth lobes 3, free, triangular, valvate; stamens basally fixed; filaments short; anthers disc shaped, opening by longitudinal slits. *Female flowers* cylindric or narrowly ellipsoid; c. 2 mm long; perianth united into a short tube at base, lobes 3, persistent, triangular to suborbicular; ovary inferior; style short and stigma mamilliform. *Fruits* narrow, ovoid to ellipsoid, smooth or tuberculate, crowned by persistent perianth lobes, bright red in colour with viscous pericarp.

Distribution: Nine species are distributed from India (Andaman Islands) southwards to Sri Lanka, eastwards and southeastwards through Malesia to

New Guinea and Solomon Islands. In India, only one species is reported from Andaman Islands.

Habitat: Mostly occurring in closed humid forests, often extending to open woodlands and disturbed habitats; common in low lands but sometimes up to an altitude of 2100 m. Host specification very low (Barlow, 1997).

Note: Stem in most of the *Ginalloa* species remains green for long. It is similar to *Notothixos* in having both normal leaves and rudimentary cataphyll like leaves on each branch system, but differs in having more variable pattern and some species bearing a very few normal leaves.

The basic inflorescence unit is a small dichasium (a cymule which is a triad), usually with both male and female flowers. During prolific flowering exclusive female cymules are also produced. The spicately arranged cymules are a consistent feature of *Ginalloa* although in some species they are reduced to solitary flowers (Barlow, 1997).

Van Tieghem (1894) proposed to treat this genus under a separate family Ginalloaceae.

Ginalloa andamanica Kurz in J. Asiat. Soc. Bengal 41(ii): 309. 1872 & For. Fl. Brit. Burma 2: 326. 1877; Hook.f., Fl. Brit. India 5: 228. 1886.

Type: Photo (K); BSI 8136 (Negative, CAL).

Large semi-parasitic shrubs; stems terete, dichotomously branched. *Leaves* opposite, thickly coriaceous, shortly petioled, stout, flat, obovate-oblong, tip rounded, obscurely 3-5-nerved, 3-5 cm long. *Spikes* 4, robust, terminal and at the forks of stem branches. *Flowers* minute, clustered, dioecious, sunk in fleshy rachis of spikes and by a thin dilation of rachis; perianth segments 3, triangular; immature fruit elongate, ovate.

Distribution: Endemic to South Andaman Islands.

Note: The above description is based solely on the protologue and *Flora of British India*, as no specimen is available in any Indian herbaria. Even J. D. Hooker could not see any specimen and based his descriptions purely on the protologue. This species has not been reported or collected since the original collection. J. D. Hooker (1886) and Barlow (1997) have expressed their doubts regarding the existence of this species. However, there is a photograph of a specimen in Kew with Danser's determinavit slip indicating the specimen as *G. andamanica*. This specimen is in a damaged state and hence difficult to determine the authenticity.

Korthalsella van Tiegh.

Korthalsella Van Tiegh. in Bull. Soc. Bot. France 43: pp. 83, 163. 1896; Gamble in J. Asiat. Soc. Bengal 75(2): 384. 1914; Engler & Krause in Engler, Pflanzenfam. 16b: 182 - 203. 1935.

Type species: Korthalsella remyana van Tiegh.

Monoecious, aerial semi-stem-parasites, undershrubs or herbs, perennial, often less than 10 cm high, rarely up to 20 cm high, found mostly on dicotyledonous woody plants, rarely on conifers, glabrous except for the floral clusters; stems green or yellowish, strongly articulated at nodes; internodes often flattened or terete, if flattened, the flattening being always in the same plane, forming a cladode. *Leaves* rudimentary, opposite, united in pairs to form collars at the top of internodes subtending floral clusters. *Flowers* 3 merous, developing successively in lateral clusters, surrounded and separated by multicellular, sparsely branched, thick walled hairs (derived from floral bracts) which often forming a raised mound (floral cushion); floral clusters sometimes coalescing and completely encircling the stem at each node; first formed flower male and arising in an axillary position; subsequent flowers developing laterally to the first and often also in further transverse rows below the first, mostly female. *Male flowers* globose in the bud state, attenuate at the base and shortly stipitate; perianth lobes persistent, triangular, valvate; stamens 3, without filaments, 6 locular, introrse, connate into a globose synandrium with the 6 loculi opening towards the centre with the slits and pouring out the pollen from a single apical pore; pollen grains globose, smooth. *Female flowers* globose, clavate or pear-shaped in bud state, usually less than 0.5 mm long, 3-merous; perianth shortly tubular at base, lobes triangular, persistent, valvate; ovary inferior; stigma nipple-shaped; embryo sacs first growing downward from the central parenchyma-mass, then growing upward into ovary wall and finally becoming 'U'-shaped. *Fruits* clavate or pear-shaped or ellipsoid, up to 3 mm long crowned by persistent perianth lobes, containing one flattened seed in the upper portion, dehiscing explosively.

Distribution: About 25 species are distributed in Asia, Australia and Africa, from Japan to Australia and New Zealand, extending eastwards to several Pacific Archipelagos and westwards to Indian Ocean Islands and Ethiopia. In India, only one species is found above 1800 m altitude in the Himalayas and the Nilgiri Hills. The distribution is disjunct, probably due to the lack of required altitudinal range and hosts in between.

Habitat: In India, it is mostly found, though not so frequent, in humid forests above 1800 m but extends to savannah. It is never recorded in lowlands of India. It is rare. Specificity of hosts might have played a key role in its distribution.

Note: *Korthalsella* is homogenous in inflorescence and floral characters, but species vary strikingly in general appearance owing to differences in vegetative characters and in degree of differentiation of flower bearing stems. The leaf pairs are distichous or decussate in species with terete or weakly compressed internodes. In strongly flattened internodes the flattening is in one plane. All nodes may bear flowers in some species or may be restricted in others. The hairs which form the floral cushion are probably modifications of very densely fimbriate floral bracts and hence, are probably homologous to the hairs of some *Ginallia* species.

The most significant work on the genus is that of van Tieghem (Bull. Soc. Bot. France 43: 83 - 87, 162 - 167. 1896). He was the first to recognize *Korthalsella* as a genus distinct from *Viscum*. He further recognised 2 more genera, *Bifaria* and *Heterixia*, which are now regarded as congeneric to *Korthalsella*. Most of the van Tieghem's species have been reduced to synonyms (Barlow, 1997). Danser (1937) published a world revision of *Korthalsella*.

Korthalsella japonica (Thunb.) Engler in Engler & Prantl, Pflanzenfam. Nachtr. 1: 138. 1897; Gamble, Fl. Pres. Madras 7: 1256. 1925; Grierson & Long, Fl. Bhutan 1(1): 151. 1983; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 414. 1987; Barlow in Fl. Malesiana 13: 421. 1997. *Viscum japonicum* Thunb. in Trans. Linn. Soc. London 2: 329. 1794; Hook.f., Fl. Brit. India 5: 226. 1886. *Bifaria japonica* (Thunb.) van Tiegh. in Bull. Soc. Bot. Fr. 43: 175. 1896. **Fig. 2**

Korthalsella opuntia (Thunb.) Merr. in Bot. Mag. Tokyo 30: 68. 1916, *comb. illegit.*; Danser in Bull. Jard. Bot. Btzg. III, 11: 453. 1931; *ibid.* 14: 134. 1937 & *ibid.* 16: 333. 1940. *V. opuntia* Thunb., Fl. Japon. 64. 1784, *nom. superfl.*

Type: Herb. Thunberg (n. v.).

V. moniliforme Wight & Arn. var. *coralloides* Wight, Icon. Pl. Ind. Or. t. 1019. 1845. *V. japonicum* Thunb. var. *coralloides* (Wight) Hook.f., Fl. Brit. India 5: 227. 1886. *K. japonica* (Thunb.) Engler var. *coralloides* (Wight) Gamble, l. c. 1925. *Bifaria coralloides* (Wight) van Tiegh. in Bull. Soc. Bot. Fr. 43: 175. 1896.

Monoecious, yellowish, aerial semi-parasites, up to 10 cm long (rarely up to 20 cm), relatively slender, much branched; branching di- or trichotomous, the

main stem with about 8-25 internodes, the unbranched extremities with about 5 internodes, often densely flabellately branched by the occurrence of collateral branches arising from the nodes, plants basally cylindrical and flattened at the apex, the following internodes strongly flattened, narrow spatulate to oblong-spatulate, gradually narrowed towards apex, 10-25 mm long, 4-8 mm

lowermost, gradually emerging from the axils, first a few-flowered and later many, up to 8 per cluster, the opposite clusters meeting and encircling the stem. *Male flowers* solitary, globose, c. 0.75 x 0.75 mm; anthers united to form a synandrium in the centre. *Female flowers* large, c. 1.5x0.75 mm, ovules not distinct. *Fruits* subpyriform, usually 1-2 mm long.

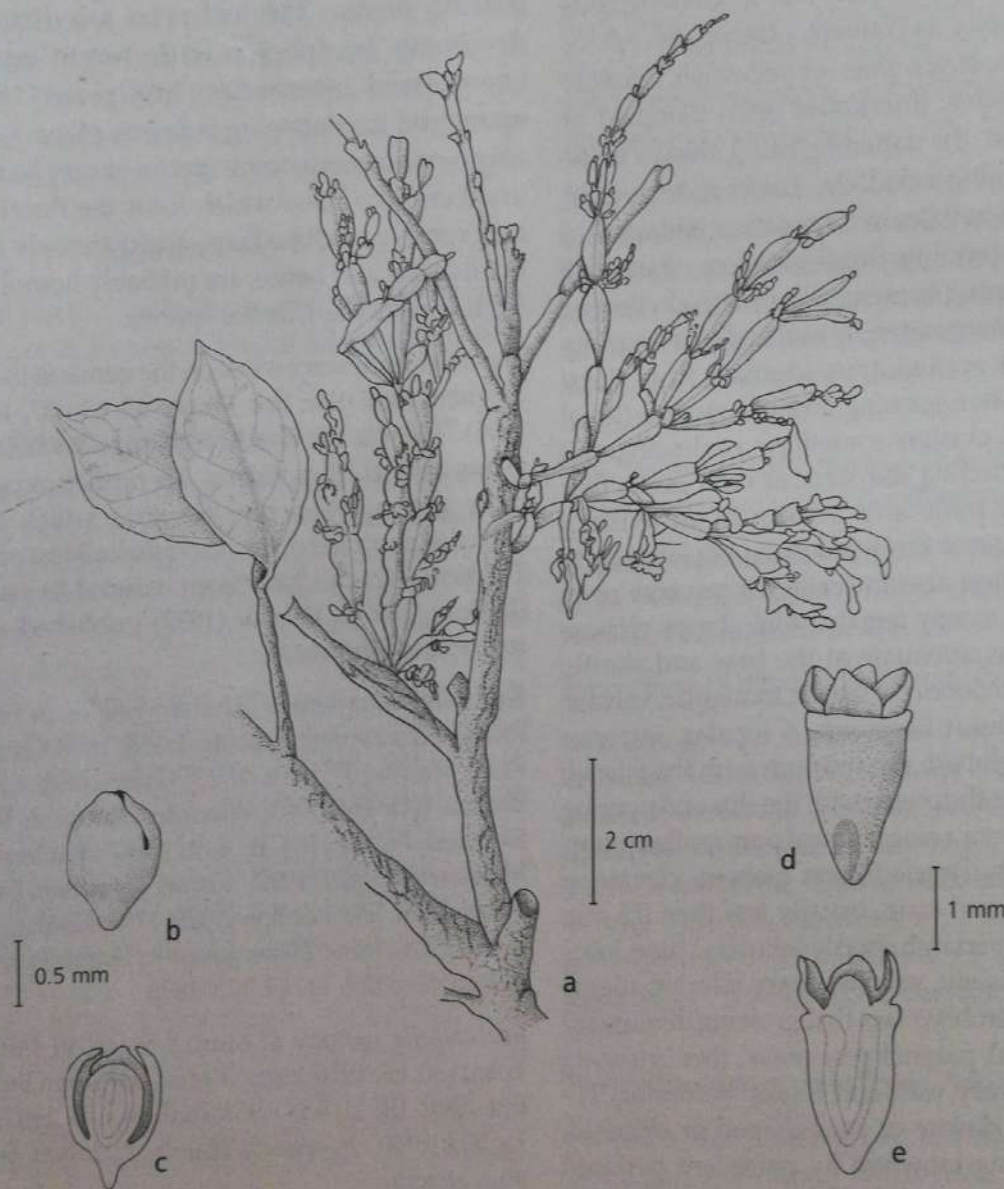


Figure 2. *Korthalsella japonica* (Thunb.) Engler - a. Habit; b. Male flower; c. Male flower, l. s.; d. Female flower; e. Female flower, l. s.

broad, with one prominent midrib and usually 3-5 lateral veins. *Leaves* rudimentary, encircling the node, 0.2 - 0.5 mm long, usually thin, truncate. Hairs of the floral cushion a few or absent, if present probably modifications of very small bracts, scarcely protruding, reddish. *Flowers* less than 1 mm across, in a cluster from the axils with the exception of the

Flowering & Fruiting: March-August.

Distribution: India (the Himalayan ranges, hill ranges of NE India and the high hills of the Western Ghats, mostly between 1000-2500 m), Bhutan, Japan, Malasia, Australia, Indian Ocean Islands and Pacific Islands.

Habitat: Moist deciduous forests of the hill tops, occasionally in savannahs. So far this species has not been reported from the plains.

Hosts: Mostly *Rhododendron* species, occasionally on *Eurya japonica* Thunb. Conifers are generally avoided. Joseph and Deka (1960) record several additional hosts from Cherrapunji in Meghalaya: *Cinnamomum zeylanicum* Blume, *Camellia caudata* Wall., *Styrax hookeri* C.B. Clarke, *Phyllanthus glaucus* Wall. ex Mull. Arg. and *Photinia arguta* Lindl. In Bhutan, it has been reported on *Quercus semicarpifolia* Sm.

Note: *K. japonica* var. *coralloides* (Wight) Gamble is a smaller form with narrower joints, a very variable character and not considered worthy of separate entity.

Specimens Examined: **Arunachal Pradesh**, Marumboan roadside, 4000 ft., 20.9.1859, Duthie 19054 (CAL); Mount Khazi, 4500 ft., *Hooker s. n.* (Accn No. 396096, CAL); without exact locality, 3750 ft., 9.5.1886, *Clarke s. n.* (Accn No. 43729, CAL); Kameng, 3250 ft., 14.11.1885, *Clarke* 41982 (CAL); Mount Khazi, 4000-5000 ft., *Hooker & Thomson* 70831 (MH). **Himachal Pradesh**, Koditali, 5200 ft., 17.6.1974, *Wadhwa* 53002 (BSD); Agrakhal, 1400 ft., 8.4.1981, *Anil* 73039 (BSD); Urui, 2800 m, 29.8.1963, *N.C. Nair* 30099 (BSD); Lahul, 1950 ft., 23.7.1963, *V.J. Nair & Malhotra* 28301 (BSD); Karcham, 26.8.1973, *Janardhanan* 52837 (BSD); Kilbam-Karcham Road, 10.10.1971, *Janardhanan* 46600 (BSD); Thal, 2200 m, 4.5.1962, *Bhattacharya* 21390 (BSD); Nayan-Najar Bridle Path, 1800 m, 1.8.1969, *Arora* 38409 (BSD); Simla, 6000 ft., June 1881, *Brandis* 1532 (DD); Simla, 7000-8000 ft., 20.5.1888, *Browne* 7352 (DD); Simla, 7500 ft., 18.6.1937, *Parkinson* 7393 (DD); Baswer, 8000 ft., 11.9.1896, *Gammie* 18576 (DD); Kilba, 6000 ft., 21.5.1928, *Parker* 2871 (DD); Kilba, 15.7.1953, *Sethi & Raizada* 20320 (DD); Karcham, 20.6.1973, *Janardhanan* 52837 (CAL); Vatiaana, 8000 ft., 30.4.1907, *Burkill* 28686 (CAL); Chamba, 6000 ft., 30.5.1898, *Lace* 1702 (CAL). **Jammu & Kashmir**, Baswar, 31.5.1986, *Uniyal* 80341 (BSD); Karinah Bagh, 4000-7000 ft., 19.7.1906, *Keshavanand* 240 (DD); Muzafarbad, 3000-6000 ft., August 1907, *Harkishen Singh* 1844 (DD); Dharmasala, August 1906, *Parker* 10004 (DD); Kilba, 7.6.1935, *Lawrie* 5398 (DD). **Kerala**, Idukki, Kanthallur, 2120 m, 30.3.1978, *Nambiar* 272 (KFRI); Kottayam, Umayamalai, 2125 m, 18.11.1965, *Shetty* 26493 (MH); Munnar, 2300 m, 27.5.1994, *Stephen* 7565 (KFRI). **Meghalaya**, Cherrapunji, 1200 m, *Joseph & Deka s. n.* (ASSAM). **Sikkim**, *King* 1287 (CAL); *Wight* 49, 50 (CAL). **Tamil Nadu**, Coimbatore, way to Thenkamalai from Konalar, 1975 m, 17.2.1980, *Chandrabose* 65828 (MH); Kodaikanal, 26.4.1905, *Barber* 7316 (MH); Kodaikanal, Pillar rock, 2333 m, 9.3.1958, *Subramanyam* 5539 (MH); *ibid.* 26.4.1905, *Barber* 7318 (MH); Nilgiri, Glenmorgan, 2000 m, 24.4.1971, *Rathakrishnan* 38055 (MH); Longwood R. F., 1875 m, 17.5.1971, *Vajravelu* 38426 (MH); Avalanche, 1925 m,

29.3.1972, *Vivekananthan* 40638 (MH); Naduvattam, 2000 m, 18.1.1961, *Shetty* 11923 (MH); Ootacamund, 15.5.1904, *Barber* 6430 (MH); 18.5.1904, *Barber* 6440, 6442, 6443 (MH); Lakkadi, 2250 m, 2.6.1970, *Shetty* 34061 (MH); Nanjanad, 2150 m, 7.7.1970, *Ellis* 34504 (MH); Pykara, 2075 m, 17.7.1970, *Ellis* 34635 (MH). **Uttaranchal**, Garhwal, 1864, *Falconer* 504 (CAL); Laria kunta, 7700 ft., 20.6.1914, *Dutt* 8036 (DD); Mussoorie, 6500 ft., 12.6.1894, *Forster* 82 (CAL). Tehri, 1400 m, 31.5.1979, *Goel* 67753 (BSD); Kumaon, Didihat, 1500 m, 22.7.1965, *Pant* 35113 (BSD); Didihat, 1500 m, 8.3.1965, *M.A. Rau* 35312 (BSD); Kumaon, Champavati, 1700 m, 9.5.1961, *Bhattacharya* 15040 (BSD); Kumaon, Duthie 4371 (DD).

Viscum L.

Viscum L., Sp. Pl. 2: 1023. 1753 et Gen. Pl. ed. 5: 448. 1754.

Type species: *V. album* L.

Aspidixia (Korth.) Van Tiegh. in Bull. Soc. Bot. France 43: 191. 1896. *Viscum* sect. *Aspidixia* Korth., Verh. Bat. Genovtsch. 17: 235. 1839.

Type species: *V. articulatum* Burm.f.

Aerial semi-stem-parasites, glabrous, monoecious or dioecious, herbs or shrubs, usually less than 1 m tall, mostly glabrous, spreading along branches of hosts, densely dichotomously or trichotomously branched, erect or sometimes pendulous; nodes swollen; internodes terete or compressed or flattened decussately, often longitudinally ridged or striate. **Leaves** present, rudimentary or absent, normally developed leaves opposite, entire, unifacial, curvinerved, usually with 3 or 5 visible veins; rudimentary leaves bract-like, up to 1 mm long. **Flowers** uniform, usually 4-merous, arranged in inflorescences which are terminal or axillary and sometimes solitary or fascicled, usually in triads, middle flowers of the triad being female, the lateral ones male or vice versa, sometimes all female or all male; bracts small, triangular, in pairs forming boat-shaped cupule subtending each cymule. **Male flowers** flattened, 0.5 - 1.5 mm long, 4-merous; perianth lobes triangular, valvate; anthers disc-shaped, multi-loculate, opening by pores, sessile and fused to the perianth lobes; pistillode absent. **Female flowers** cylindric, oblong, up to 3 mm long, 4-merous; perianth lobes triangular, sometimes persistent; ovary inferior, ovules not distinct; style short, subconical; stigma small, nipple-shaped, rounded, flat or capitate. **Fruit** a berry, usually dehiscent, narrowly ellipsoid, perianth lobes rarely persistent as a crown on the fruit.

Distribution: About 100 species distributed in southern Europe, throughout tropical Africa and eastwards to tropical and subtropical Asia, Malasia and Australia. In India 15 species are present, of which 4 are endemic.

Habitat: The species of *Viscum* occur in a range of habitats from dense wet evergreen forests, moist deciduous forests to open lands and disturbed areas. They are adapted to live from sea level to 2500 m altitude.

Morphology: In most of the species of *Viscum*, the stems remain green for a long time. Plants are leafy or leafless. The basic inflorescence unit is a simple cyme (triad), which is usually 3-flowered. The inflorescences are subracemose, sessile or pedunculate, terminal or axillary.

Key to species

- 1a. Plants dioecious, leafy; leaves lanceolate to elliptic-lanceolate or obovate-lanceolate; central flower subtended by a cupule **V. album**
- 1b. Plants monoecious, leafy or leafless; leaf-shape varying; central flower subtended or not by a cupule. 2
- 2a. Internodes flattened; leaves a few, lanceolate; inflorescence a 3-flowered cyme with the central flower female **V. mysorens**
- 2b. Internodes terete, angular or flattened; leaves a few or many, shape varying; inflorescence cymose or subracemose with the central flower either male or female 3
- 3a. All plants leafless (rarely leafy in *V. ramosissimum*); internodes flat, angular or terete; inflorescences sessile 4
- 3b. All plants leafy; internodes terete; inflorescences sessile or pedunculate..... 5
- 4a. Internodes of young branches distinctly 4-angled; flowers arranged laterally **V. angulatum**
- 4b. Internodes of young branches terete or flattened; flowers arranged laterally or encircling the node 6
- 5a. Central flower male; leaves cuneate, subtruncate, ovate, obovate or lanceolate 9
- 5b. Central flower female; leaves lanceolate, oblong, ovate-acute 10
- 6a. Internodes flattened in a plane at right angles to the preceding one, contracted at nodes; inflorescences lateral **V. articulatum**
- 6b. Internodes terete, not distinctly contracted at nodes; inflorescences lateral or around the node 7
- 7a. Plants erect; fruits verruculose, subglobose **V. loranthi**
- 7b. Plants drooping; fruits smooth, globose to ovoid 8
- 8a. Branches strong; inflorescence encircling the node; fruits with persistent bracteal cup **V. malurianum**
- 8b. Branches slender; inflorescence lateral; fruits without bracteal cup **V. ramosissimum**
- 9a. Internodes terete; leaves falcate; young fruits smooth, flask-shaped; inflorescence sessile **V. monoicum**
- 9b. Internodes terete or slightly angular; leaves variously shaped; young fruits smooth or warty, globose or oblong; inflorescence sessile or pedunculate 11
- 10a. Leaves large, c. 5 x 2 - 3.5 cm; inflorescence sessile; fruits warty **V. ovalifolium**
- 10b. Leaves small, c. 2 - 5 x 0.5 - 2 cm; inflorescence pedunculate; fruits smooth 13
- 11a. Internodes longitudinally grooved; leaves ovate, obovate or oblong; young fruits warty **V. heyneanum**
- 11b. Internodes not longitudinally grooved; leaves lanceolate, cuneate or subtruncate; young fruits smooth 12
- 12a. Inflorescences distinctly pedunculate, at times subracemose; internodes terete throughout; leaves lanceolate, thick; perianth lobes 2 (rarely 3) for male and 3 for female **V. capitellatum**
- 12b. Inflorescences sessile, never subracemose, always cymose; leaves cuneate, subtruncate or suborbicular; upper internodes slightly angled; perianth lobes 3 in both male and female **V. trilobatum**
- 13a. Internodes longitudinally grooved; leaves lanceolate to ovate-lanceolate; inflorescences subracemose, sometimes only with female flowers, fruits globose **V. subracemosum**
- 13b. Internodes terete or longitudinally grooved; leaf shape varying; inflorescences cymose or

subracemose, heterosexual; fruits globose or oblong14

14a. Branches slender; leaves lanceolate, inflorescences always 3-flowered **V. acaciae**

14b. Branches strong, terete; leaves ovate, obovate, acute at apex, inflorescences up to 5-flowered **V. orientale**

Viscum acaciae Danser in Blumea 4: 298. t. 1. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 150. 1957; Sanjai & N.P. Balakr., J. Econ. Taxon. Bot. 25(1): 18. fig. 1. 2001.

Fig. 3

Type: Burma (Myanmar), Magwe dist., Ywamun-Shwetandaw, 800 ft., 7.9.1925, Robertson 1823 (DD!).

Semi-parasitic herbs, monoecious, leafy evergreen, drooping, up to 75 cm long or even more; stems slender, dichotomously branched at all nodes towards the basal portion and less branched upwards; branches at each node 3 or 2, lower internodes terete, slender, longitudinally grooved, not flattened, 2 - 7 x 0.1 - 0.3 cm; nodes slightly swollen; internodes towards the apices gradually more delicate, short. *Leaves* petiolate, lanceolate or subspathulate to spathulate, tapering at base, rounded at apex, entire or slightly wavy along the margins, with 3 distinct longitudinal veins, 1.5 - 7 x 0.5 - 2 cm; petioles 2 - 5 mm long. *Inflorescence* single, usually lateral at the axils of leaves, but occasionally terminal, up to 6 at each node, cymose, usually 3-flowered but sometimes with up to 5 flowers; peduncles 3 - 7 mm long, bearing a navicular cup of bracts formed of 2 segments at its apex, each bract triangular, c. 3 x 2 mm, bearing a 3-flowered triad in it, the central flower large and female, the laterals male, sometimes the central flower absent and instead developing another set of flowers in a peduncled cyme of the same size and structure. *Male flowers* slightly wedge-shaped, sessile, c. 1.5 x 1 mm; perianth lobes 4, 2 larger and 2 smaller, the larger lobes c. 1 x 0.75 mm, broadly ovate with broad base and rather rounded apex, bearing an anther on its inner surface; the smaller perianth lobes c. 1 x 0.5 mm, oblanceolate, with slightly broad base and acute to acuminate apex, without anthers attached to them; stamens 2, sessile, opposite to and attached on the inner surface of the larger perianth lobes; anthers c. 0.75 x 0.75 mm, opening by pores; pistillode absent. *Female flowers* sessile, oblong, clavate, c. 3 x 1 mm; perianth lobes 4, free, valvate, c. 1 x 0.75 mm, caudate; staminodes absent; ovary inferior, ovules not distinct; style short; stigma globular. *Fruits* drupaceous, oblong, 5 - 8 x 3 - 5

mm, abruptly tapering at base into the stalk, smooth.

Flowering & Fruiting: February-August.

Distribution: India (Karnataka), Myanmar.

Note: Earlier, this species was known only from its type locality and adjacent areas in Myanmar (Burma). The first author collected this species from Bangalore in Karnataka state and reported it as a new record for India. R.S. Rao (1957) did not mention the occasional subracemose nature of inflorescence and occurrence of more than one fruit in an inflorescence in this species.

Hosts: *Acacia leucophloea* (Roxb.) Willd. and *Santalum album* L. are the common hosts. In Bangalore this species was collected from *Santalum album* where *Viscum acaciae* was seen mimicking the leaf and stem of its host (Sanjai & Balakrishnan, 2001 a,b,c).

Specimen Examined: Karnataka, Bangalore, 1.5.1997, Sanjai 104935 (MH).

Viscum album L., Sp. Pl. (ed. 1), 2: 1023. 1753; Brandis, For. Fl. N.W. & C. India 392. 1874; Kurz, For. Fl. Brit. Burma 2: 323. 1877; Boiss., Fl. Orient. 4: 1065. 1879; Aitchinson in J. Linn. Soc. Bot. 18: 92. 1880, p. p.; Benth. & Hook.f., Gen. Pl. 3: 213. 1880; Hook.f., Fl. Brit. India 5: 223. 1886; Gamble, Indian Timbers 583. 1902; Collett, Fl. Simlensis 440. 1902; Brandis, Indian Trees 552. 1906; Parker, Fl. Pl. Punjab 441. 1924; C.E.C. Fischer in Rec. Bot. Surv. India 11: 160. 1926; Osmaston, Forest Fl. Kumaon 465. 1927; Danser in Blumea 2: 55. 1936; Danser in Bull. Jard. Bot. Btzg. (ser. 3), 16: 58. 1938; Danser in Blumea 4: 268. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 118. 1957; Grierson & Long, Fl. Bhutan 1(1): 150. 1983.

Fig. 4

Type: Linnaeus 1166-1 (LINN - Microfiche!).

Viscum costatum Gamble in Bull. Misc. Inf. Kew 1913: 46. 1913.

Type: India: Darjeeling, the shrubbery, 7000 ft., Gamble 711 (K).

Viscum album var. *meridianum* Danser in Blumea 4: 274. 1941.

Type: India: Assam, Naga Hills, R.N. De 17461 (ASSAM).

Semi-parasitic shrubs, evergreen, dioecious up to 75 cm high; stems dichotomously or trichotomously or even umbellately branched; number of branches up to 10 or sometimes more; nodes swollen; internodes terete, smooth and green when young but wrinkled and yellowish when dried. *Leaves* normal, opposite, sessile or subsessile, exstipulate, lanceolate-elliptic to

obovate-lanceolate or sometimes obovate-cuneate, usually oblique with one side straight and the other slightly curved, obtuse or rotund at apex, entire, abruptly narrowed towards the base, c. $2.5 - 10 \times 0.5 - 3.7$ cm, thin, coriaceous with 3-9 longitudinal nerves connected together by indistinct reticulate veins, prominent when dry. Inflorescences cymose, terminal or axillary at bifurcations of stems towards the basal portion, peduncled. Male flowers cymose with 3-

flowers, central the older, laterals the younger, all protected in a connate cup of two acute, short and round or larger and triangular bracts, the central flower with an individual bracteal cup of its own similar to that of the inflorescence; flowers globose, basally slightly conical c. 2.5×2.5 mm; perianth lobes 4, valvate with a short perianth tube, triangular, broadly ovate, acute at apex, c. 1.75×1 mm; stamens 4, sessile; filaments absent; anthers sessile, attached

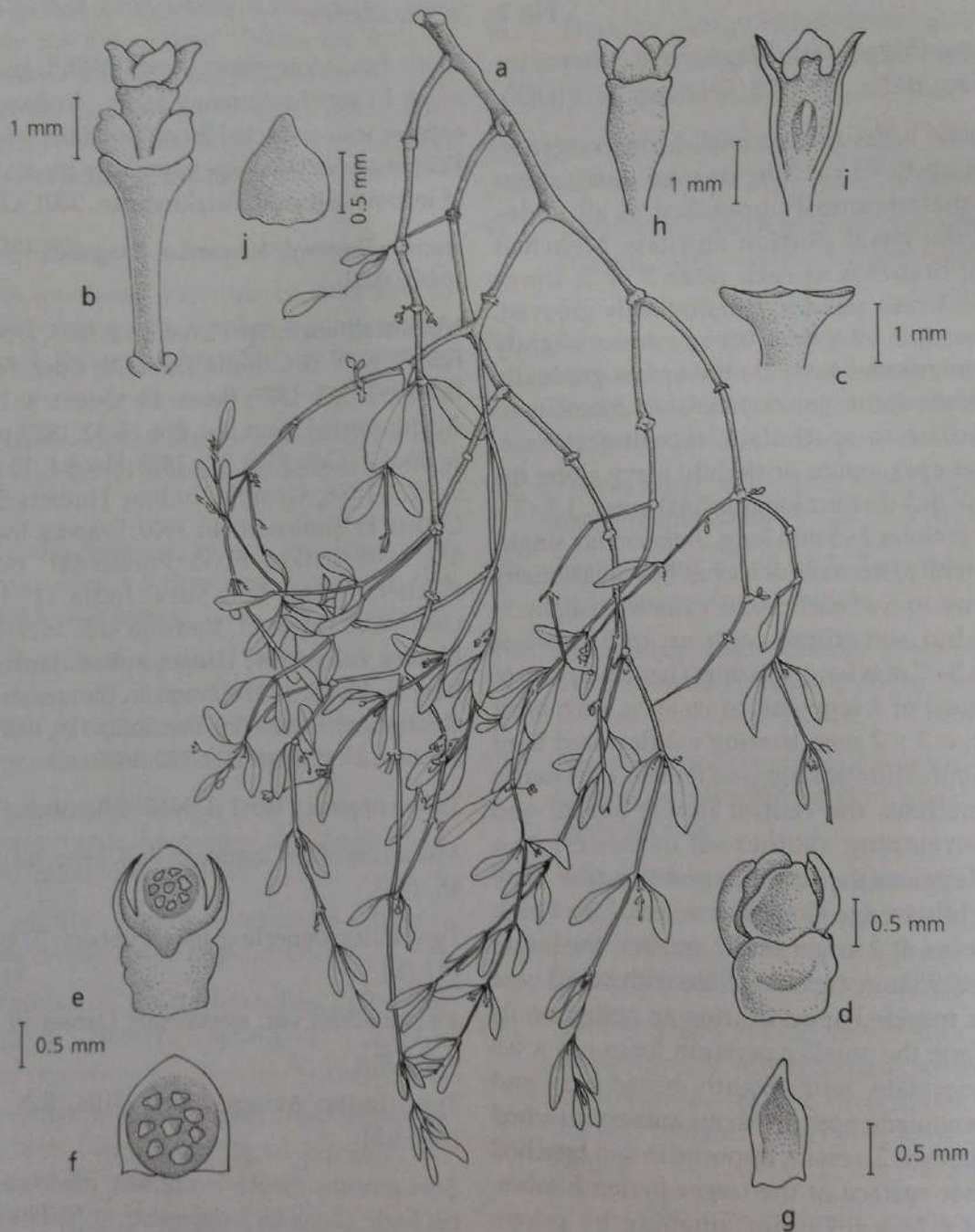


Figure 3. *Viscum acaciae* Danser - a. Habit; b. Inflorescence; c. Bracteal cup; d. Male flower; e. Male flower, l. s.; f. Large perianth lobe with anther; g. small perianth lobe; h. Female flower; i. Female flower, l. s.; j. Female perianth lobe.

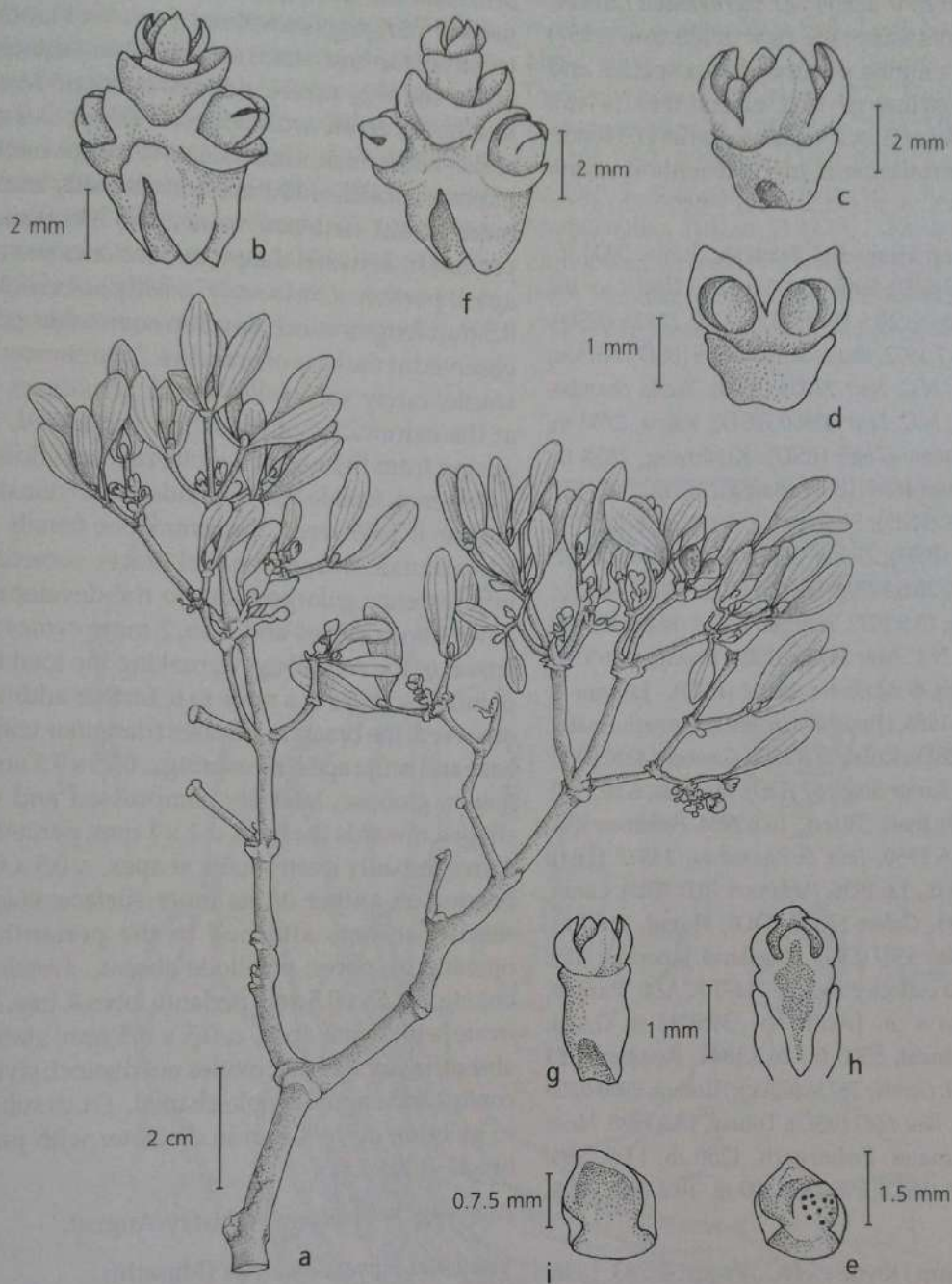


Figure 4. *Viscum album* L. – a. Habit, female plant; b. Male inflorescence; c. Male flower; d. Male flower, l. s.; e. Male perianth lobe with anther; f. Female inflorescence; g. Female flower; h. Female flower, l. s.; i. Female perianth lobe.

to the inner surface of perianth lobes; pistillode absent. *Female flowers* cymose with 3-5 flowers, protected by a pair of connate, acute bracts forming a cupule; bracts as in male inflorescence; flowers smaller than the male, oblong, c. 2×1 mm; perianth lobes 4, valvate, perianth tube fused with the inferior ovary; ovules not distinct; style short; stigma small and flat. *Fruits* globose or ellipsoid, 4-8 mm long, white.

Flowering & Fruiting: February-October.

Vernacular names: Harchur (Nepali).

Distribution: India (Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Sikkim, Assam and Arunachal Pradesh), Temperate Europe and Asia.

Chromosome number: $n = 10$ (Pisek, 1924; Steindl, 1935).

Hosts: Species of *Abies*, *Acer* and *Ulmus*.

Note: With regard to *V. album* var. *meridianum* Danser, the present authors accept the view of R.S. Rao (1957) that *V. album* is a highly polymorphous species and the slight variation in leaf characters is too insignificant to keep it as a separate variety. Hence, *V. album* var. *meridianum* is merged with *V. album* proper here.

Specimens Examined: **Himachal Pradesh**, Simla, 5000 ft., 1898, Gamble 62269 (DD); Simla, 7000 ft., 18.5.1890, Lace 167 (CAL); Jeon, 1600 m, 25.5.1962, N.C. Nair 21823 (BSD); Manali, 1900 m, 16.7.1972, Bhattacharya 48559 (BSD); Nichar, 2300 m, 28.5.1962, N.C. Nair 22008 (BSD); Tsella chamba, 1800 m, 27.7.1964, N.C. Nair 32860 (BSD); Kalpa, 2750 m, 3.6.1972, Janardhanan 47665 (BSD); Kushrang, 2850 m, 2.10.1971, Janardhanan 46380 (BSD); Baspa, 2825 m, 21.9.1971, Janardhanan 46148 (BSD); Shangtong, 1970 m, 6.10.1971, Janardhanan 46476 (BSD); Zimmar, 30.8.1963, N.C. Nair 30139 (BSD); Bharmisain, 26.6.1979, Naithani 68125 (BSD); Sangla, hill slopes, 2650 m, 15.5.1972, Naithani 63758 (BSD); Rohim, 1800 m, 18.7.1965, N.C. Nair 35790 (BSD); Bharmar, 1650 m, 23.7.1963, V.J. Nair & Malhotra 28332 (BSD). **Jammu & Kashmir**, Pal, 29.5.1986, Uniyal 80316 (BSD); Ferozpurinalal, 2.7.1956, Rao 401 (BSD); Kulal, 25.8.1896, Gammie 18220 (DD); Sangla, 10.4.1913, Kartar Singh 52 (DD); Jarahala, 6.10.1950, Raizada 19839 (DD); Jhari, 5300 ft., 16.8.1934, Parkinson 3906 (DD); Kagol, 14.6.1950, Jain & Bharadwaj 13517 (DD); Kotikanagar, 6000 ft., 1.6.1936, Parkinson 7037 (DD); Laran, 7000 ft., 12.9.1895, Galan 17526 (DD); Harsil, 2100 m, 24.11.1968, K.M. Nair 5307 (DD). **Nagaland**, Japonaga hills, May 1895, without collector's name 11477 (CAL). **Punjab**, Pangee, Stoliczka s.n. (Accn No. 395692 in CAL). **Uttaranchal**, Garhwal, 5500 ft., 26.3.1844, Benthams 8523 (DD); 7000 ft., 1898, Gamble 26736 (CAL); Almora, 2000-2200 ft., 2.10.1957, M.A. Rau 4743 (BSD); Tolusy, 13.8.1988, Hajra 87126 (BSD); Kumaon, Pithorgarh, 1750 m, 11.5.1961, Bhattacharya 15135 (BSD); Pangu, 1800 m, 10.3.1965, M.A. Rau 35346 (BSD).

Viscum angulatum Heyne ex DC., Prodr. 4: 283. 1830; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 380. 1834; Dalzell & Gibson, Bombay Fl. 110. 1861; Hook.f., Fl. Brit. India 5: 225. 1886; Gamble, Indian Timbers 584. 1902; Brandis, Indian Trees 552. 1906; T. Cooke, Fl. Pres. Bombay 2: 533. 1906; Talbot, For. Fl. Bombay 2: 422, 481. 1911; Gamble, Fl. Pres. Madras 7: 1259. 1925; C.E.C. Fischer in Rec. Bot. Surv. Ind. 11: 181. 1926; Danser in Blumea 4: 222. 1941; Santapau in Rec. Bot. Surv. India 16: 267. 1953; R.S. Rao in J. Indian Bot. Soc. 36(2): 140. 1957 & in Fl. Goa, Diu, Daman & Nager-Haveli 2: 374. 1986. **Fig. 5**

Type: Herbarium Heyne (n. v.).

V. ramosissimum auct. non Roxb. ex DC.: Wight, Icon. Pl. Ind. Or. 3: t. 1017 tantum, 1845; Hook. f., l. c. 225.

Semi-parasitic herbs, monoecious, green or yellowish, usually hanging, sometimes erect on branches and trunks of the host; stems slender, branches numerous, more than 2, rarely decussate at nodes; lower internodes terete with opposite ridges, 2-5 cm long and 1-4 mm thick, attenuate towards the extremities; internodes of the middle region distinctly tetragonal, more or less flattened, sometimes less distinct ribs present in between the prominent ones towards the apical portion. *Leaves* scaly, mostly not visible, up to 0.5 mm long or much smaller, sometimes prophylls observed at the base of branches. *Inflorescences* usually sessile, rarely subsessile, lateral, sometimes present at the extremities of branches, peduncled, usually arising from the nodes, 1-flowered, or 3-flowered, if 1-flowered, female and subtended by 2 connate bracts at base; if 3-flowered, the central one female and the laterals male with individual bracts, sometimes the inflorescence enlarged due to the development of adventitious cymes and if so, 2 more cymes present lateral to the central cyme, making the total number of inflorescences at a node to 6, further additions not observed; the bracts in all cases triangular with broad base and acute apex, measuring c. 0.75 x 0.5 mm. *Male flowers* globose, laterally compressed and wedge-shaped towards the base, c. 1 x 1 mm; perianth lobes 4, free, broadly ovate, acute at apex, c. 0.5 x 0.5 mm; bearing an anther on its inner surface; stamens 4, sessile; anthers attached to the perianth lobes, opening by pores; pistillode absent. *Female flowers* oblong, c. 1.25 x 0.5 mm; perianth lobes 4, free, broadly ovate with acute apex, c. 0.5 x 0.5 mm; staminodes absent; ovary inferior; ovules not distinct; style short, conical and stigma nipple-shaped. *Fruits* subglobose to globose, up to 4 mm in diameter with persistent bracts at base.

Flowering & Fruiting: February-August.

Venacular name: Bandaguli (Marathi).

Distribution: India (the Western Ghats of Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu and southern areas of Andhra Pradesh), endemic.

Hosts: *Opilia amentacea* Roxb., *Zizyphus xylopyrus* Willd., *Olea dioica* Roxb. and *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.

Specimens Examined: **Goa**, Verlium hills, 1.10.1972, Sahni 3727 (DD). **Karnataka**, Mysore, Yelandir to Biliguri road, 26.4.1962, Rao 80359 (CAL); Chathura Kallubetta, 26.3.1876, Clarke 11254 (CAL); Gopalaswamy hill, Bandipur, 1500 m, 30.1.1965, Naithani 23254 (MH); way to Bedaguli B.R. hills, 25.10.1978, Ramesh & Manohar 3846 (IISc); Pilligiri Rayan hills, 10.2.1972, Raghavendra Rao 1796 (IISc); Hassan, Balupet, Sakespur road, 13.3.1969, Saldanha 12988 (IISc); Hills beyond

Bangleshpur, 6.8.1969, Saldanha 14379 (IISc); Chickmagalur, Kaldenapura, 2.5.1978, Ahmed, Ramesh & Ravindra 876 (IISc); Shimoga, Kodajadri, 9.4.1979, Keshavamurthy & Ramesh 6265 (IISc); Kodagu, Mercara, 23.7.1979, Manohar & Ramesh 8478 (IISc). **Kerala**, Wyanad, Sultan's Battery, 900 m, 22.8.1997, Sanjai 104943 (MH); *ibid.* 14.2.1964, Ellis 18699 (MH); *ibid.* 3000 ft., Nov. 1884, Gamble 15436 (MH); Thamarassery, 30.7.1905, Barber 7400 (MH); Sugandhagiri, 9.1.1986, Antony 1715 (SBC); Kannur, Chandanathode, 1150 m, 30.6.1965, Ellis 25245 (MH); Thirunelli R.F., 700 m, 4.3.1979, Ramachandran 62103 (MH); Palghat, Ayankoil area, Nelliampathy R.F., 925

m, 13.2.1979, Bhargavan 60403 (MH); Calicut, Ottengadi, 870 m, 27.4.1978, Nambiar 337 (KFRI). **Tamil Nadu**, Nilgiri, Sirurghat, 4000 ft., June 1884, Gamble 14508 (CAL); Doddai kambai, 1800 m, 4.1.1971, Shetty 37701 (MH); Nadugani, 860 m, 31.1.1971, Ellis 37804 (MH); Gudalur, 950 m, 23.2.1973, Vajravelu 43709 (MH); Kotagiri, 1166 m, 6.1.1957, K. Subramanyam 1961 (MH); Ramanathapuram, Mudaliarathu, 1100 m, 11.12.1971, Vajravelu 39330 (MH); Eluttuparai, Ayyankoil, 450 m, 21.9.1971, Vajravelu 38647 (MH); Madurai, Sirumalai, 967 m, 25.4.1958, K. Subramanyam 5784 (MH); Lower Pulneys, 28.12.1898, Barber 2423 (MH);

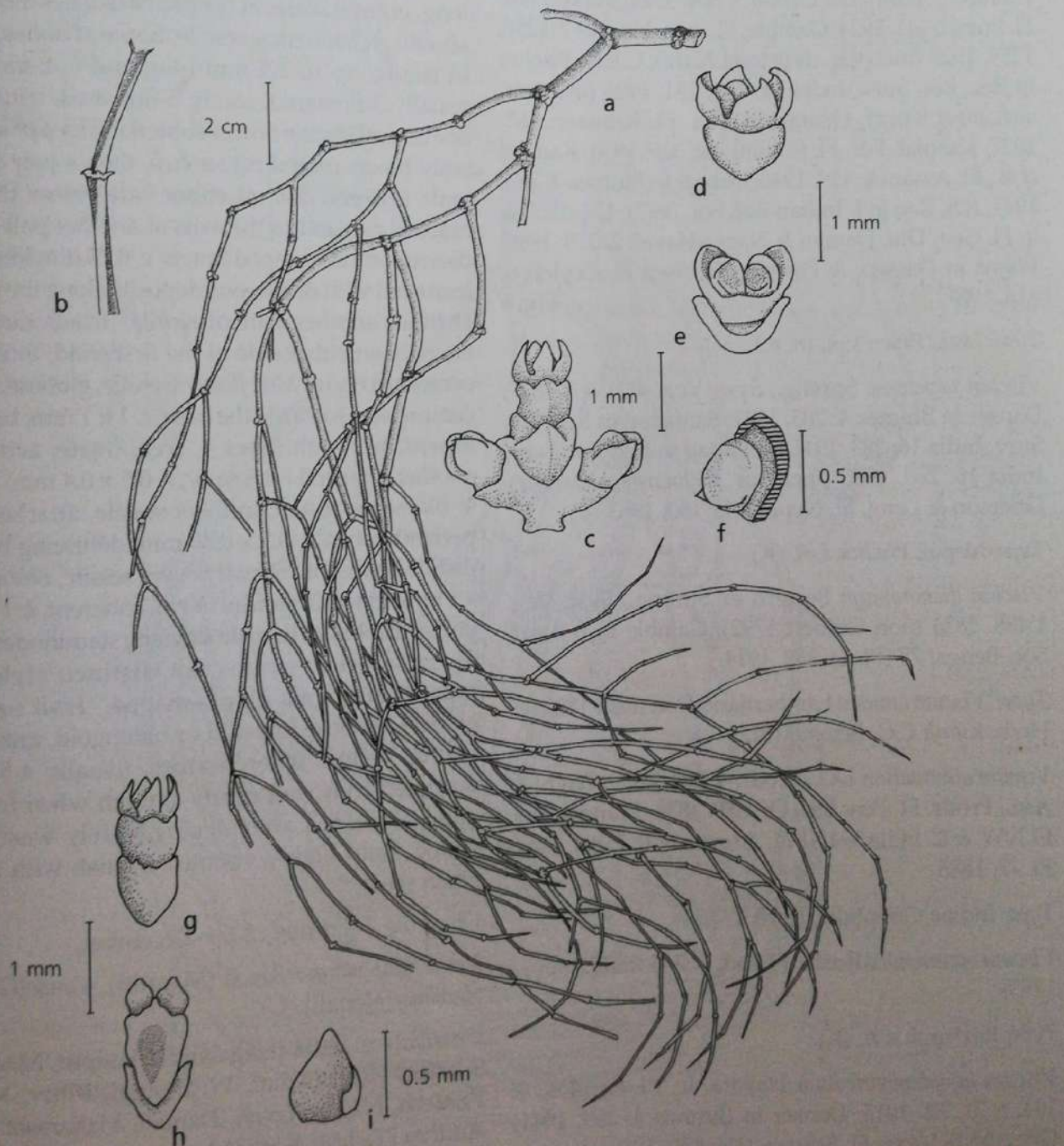


Figure 5. *Viscum angulatum* Heyne ex DC. – a. Habit; b. Portion of stem; c. Inflorescence; d. Male flower; e. Male flower, l. s.; f. Male perianth lobe; g. Female flower; h. Female flower, l. s.; i. Female perianth lobe.

Middle Pulneys, 4000 ft., *Rodriguez* 2065 (CAL); North Coimbatore, 2.3.1968, *K.N. Subramanian* 3317 (DD); Martahalli, 3200 ft., 13.2.1930, *Narayanaswamy* 19931 (MH); Poonchi, Anamalais, 24.10.1961, *Joseph* 13251 (MH).

Viscum articulatum Burm. f., Fl. Ind. 211 (311). 1768; Kurz in J. As. Soc. Bengal 40: 64. 1871; Kurz, For. Fl. Brit. Burma 2: 325. 1877 (incl. var. *dichotoma* Kurz); Hook.f., Fl. Brit. India 5: 226. 1886 incl. var. *dichotoma* Kurz); Trimen, Handb. Fl. Ceylon 3: 472. 1895; Brandis, Indian Trees 552 & 716. 1906; Gamble in J. As. Soc. Bengal 75 (Pt. 2): 389. 1914; Gamble, Indian Timbers 584. 1902; T. Cooke, Fl. Pres. Bombay 2: 553, t. 482. 1906; Duthie, Fl. Upper Gangetic Pl. 3: 65. 1915; Haines, Bot. Bihar & Orissa 5: 804. 1924; Parker, For. Fl. Punjab 441. 1924; Gamble, Fl. Pres. Madras 7: 1258, 1259. 1925 (incl. var. *dichotoma* Kurz); C.E.C. Fischer in Rec. Bot. Surv. India 11: 161, 181. 1926 (incl. var. *dichotoma* Kurz); Osmaston, For. Fl. Kumaon 465. 1927; Kanjilal, For. Fl. Philibit etc. 319. 1933; Kanjilal et al., Fl. Assam 4: 119. 1940; Danser in Blumea 4: 280. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 126. 1957 & in Fl. Goa, Diu, Daman & Nager-Haveli 2: 375. 1986; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 416. 1987.

Fig. 6

Type: Java, *Pryon* s. n. (n. v.).

Viscum nepalense Spreng., Syst. Veg. 4(2): 47. 1827; Danser in Blumea 4: 283. 1941; Santapau in Rec. Bot. Surv. India 16: 283. 1941; Santapau in Rec. Bot. Surv. India 16: 268. 1953 (incl. var. *thelocarpum* Danser); Grierson & Long, Fl. Nepal 1(1): 150. 1983.

Type: Nepal, *Wallich* s. n. (K)

Viscum dichotomum Bertero ex Spreng., Syst. Veg. 1:488. 1824 (non Gilibert 1792); Gamble in J. Asiat. Soc. Bengal 75 (Pt. 2): 389. 1914.

Type: *Viscum amuseo* Lambertiano Don misit 1822 (ex Herb. Kunth C.G. Bertero) (BD)

Viscum attenuatum DC., Prodr. 4: 284. 1830; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 380. 1834; Brandis, For. Fl. NW. & C. India 394. 1874; Trimen, Syst. Catal. Ceyl. Pl. 77. 1885.

Type: Indiae Orientalis, Herb. Heyne.

Viscum opuntioides Roxb., Fl. Ind. 3: 764. 1832 (non L. 1753).

Type: Roxburgh s. n. (K).

Viscum liquidambaricolum Hayata, Ic. Pl. Formos. 5: 194, t. 71, 72. 1915; Danser in Blumea 4: 289. 1941; Grierson & Long, Fl. Bhutan 1(1): 150. 1983.

Type: Java, *Pryon* s. n. (n. v.).

Semi-parasitic shrubs, monoecious, slightly yellowish, evergreen, drooping, up to 1 m or more; stems slender, much-branched; branches decussate, sometimes more than 2 at each node; lower internodes terete at basal portion, 2-5 cm long, up to 8 mm thick, thicker at nodes, younger upper ones slightly flattened at base, more towards the apex, flattening in a plane at right-angle to the preceding one, gradually broadening from base to tip, twisted near the base, longitudinally prominently grooved with 3-5 prominent veins, slightly thickened towards the node and truncate or rounded at apex, c. 2-6 x 0.3-1 cm. *Leaves* rudimentary, not visible, scale-like, at first erect, later spreading, obtuse, 0.5-0.75 mm long, obtuse; scales at bases of branches indistinct or absent. *Inflorescences* sessile, borne at nodes, cymose, in triads, up to 2.5 mm long and c. 2 mm broad, usually 3-flowered, rarely 5-flowered, usually with one central female flower subtended by a pair of small scaly bracts united into a cup, then a pair of lateral male flowers, one on either side below the upper bracteal cup and in the axils of another pair of lower decussately developed bracts, c. 0.75 mm long; bracts incrustated with calcareous deposits along the margins, at times another pair of similar triads developing laterally on either side of the first triad, thus up to 6 cymes at a node. *Male flowers* sessile, globose, laterally compressed towards the base, c. 1 x 1 mm; bracteoles absent; perianth lobes 4, free, ovate, acute, with another attached internally, c. 0.5 x 0.4 mm; stamens 4, filaments absent, anthers sessile, attached to the perianth lobes, c. 0.3 x 0.35 mm, dehiscing by pores; pistillode absent. *Female flowers* sessile, oblong, c. 1.5 x 1 mm; bracts 2, panduriform, coherent, c. 1 x 1 mm; perianth lobes as in male flowers; staminodes absent; ovary inferior; ovules not distinct; style short, cylindrical; stigma nipple-shaped. *Fruit* somewhat globose, globose to ovoid or oblongoid, green when young, yellow when mature, usually 4-5 mm in diameter; fruit wall nearly smooth when fresh and much wrinkled after drying, rarely warty when young, pulp highly viscous, whitish with a bright green seed.

Flowering & Fruiting: May-December.

Vernacular names: Banda (Marathi), Vando (Gujarati), Harchur (Nepali).

Distribution: India (Nagaland, Manipur, Meghalaya, Sikkim, Uttaranchal, W. Bengal, Bihar, Madhya Pradesh, Nager-Haveli, Daman, Maharashtra, Goa, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu) Tropical Asia, Australia.

Chromosome number n = 11, 12 (Barlow, 1963).

Hosts: *Kydia calycina* Roxb., *Grewia tiliaefolia* Vahl, *G. rotundifolia* Juss., *Ochna squarrosa* Bennett, *Zizyphus jujuba* Lam., *Rhus mysorensis* Roth, *Buchanania lanzan* Sprengel, *Dalbergia latifolia* Roxb., *Cassia montana* Roth, *Acacia tomentosa* Willd., *Diospyros melanoxylon* Roxb., *Santalum album* L., *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn., *Quercus* sp. etc. and sometimes on species of Lorantheae, particularly *Scurrula*.

Note: This species as treated here is an amalgamation of *V. articulatum*, *V. articulatum* var. *thelocarpum*, *V. liquidambaricolum* and *V. nepalense*. Danser (1941) separated the species based on their internodal length and breadth. He distinguished var. *thelocarpum* by its warty young fruits. R.S. Rao (1957) while agreeing with Danser's variety *thelocarpum* merged the rest with *V. articulatum* and provided varietal status to *V.*

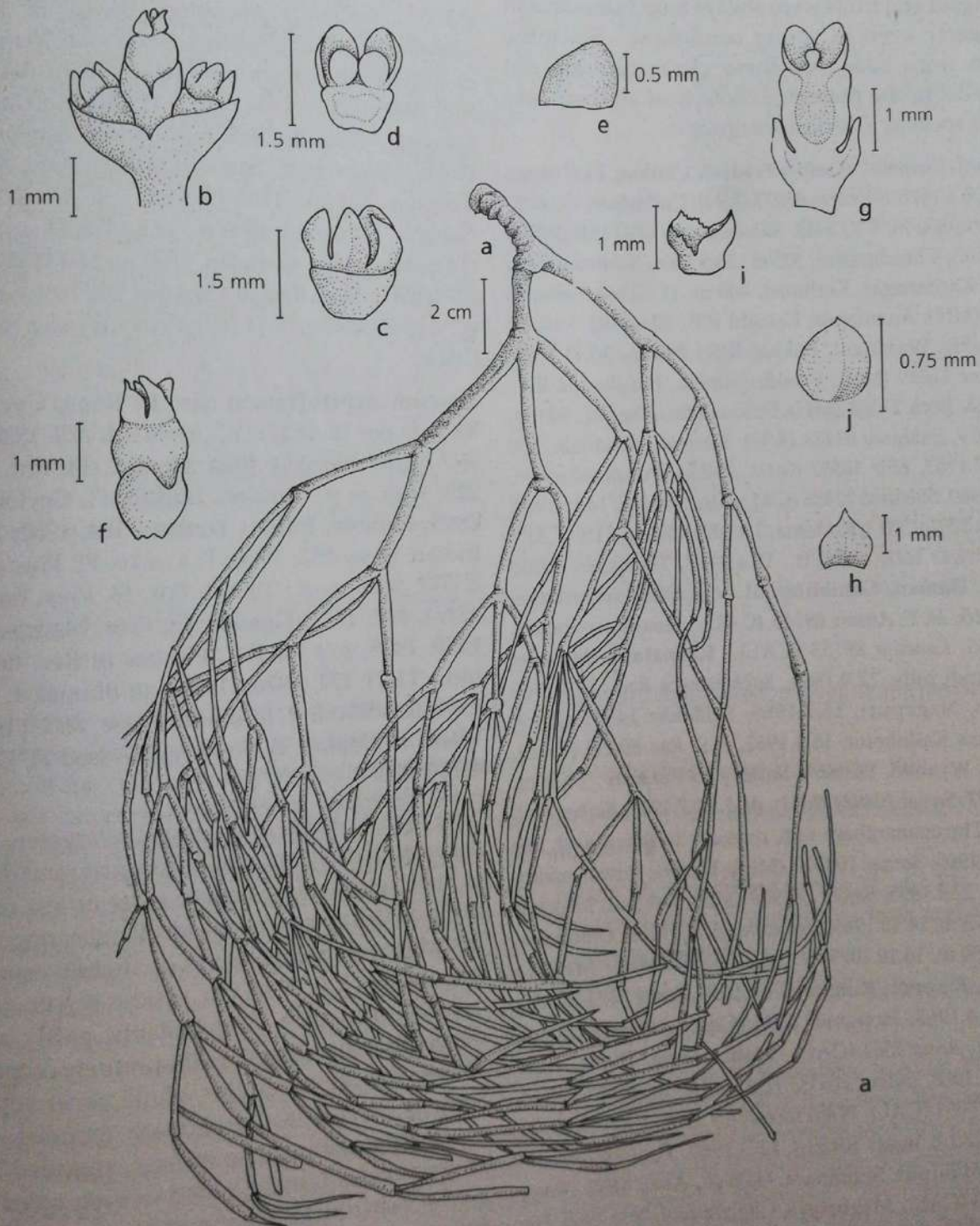


Figure 6. *Viscum articulatum* Burm.f. – a. Habit; b. Inflorescence; c. Male flower; d. Male flower, l.s.; e. Male perianth lobe with anther; f. Female flower; g. Female flower, l.s.; h. Female perianth lobe; i. Female bracteal cup; j. Female single bract.

liquidambaricolum as *V. articulatum* var. *liquidambaricolum* saying that the fruits are oblong. While merging *V. nepalense* with *V. articulatum*, he followed Danser in keeping the var. *thelocarpum* as distinct.

The present authors after examining fresh and preserved materials found that the internodal length and breadth continuously vary and the distinctions based on them do not stand. They also found that the shape of fruits varies from globose to ovoid or oblongoid and fruits were always found smooth and not warty even in young conditions. Since the distinctions based on these characters are not dependable, the present authors treat all these taxa as one species, *V. articulatum* proper.

Specimens Examined: **Andhra Pradesh**, Chittoor, Fuel camp, 650 m, 6.1.1976, Subbarao 46971 (MH); Cuddapah, Guvalacheruvu, 500 m, 8.10.1958, Subramanyam 6847 (MH); East Godavari, Cheedipalem, 325 m, 28.5.1966, Subbarao 27436 (MH); Karimnagar, Kodimial, 400 m, 17.7.1964, Subbarao 20073 (MH); Anantapur, Kekathi R.F., 30.9.1982, Pullaiah 751 (MH); Warangal, Pakhal R.F., 290 m, 30.11.1960, Sebastine 11699 (MH); Visakhapatnam, Borukonda R.F., 9.9.1923, Jacob 17158 (MH); Srikakulam, Khapur, 300 m, 22.5.1979, Subbarao 62488 (MH); Kurnool, Srisailam, 550 m, 15.7.1963, Ellis 16882 (MH). **Bihar**, Pundusabuscen, 31.12.1960, Subbarao 22986 (CAL); Murram hill, 14.11.1964, Kanodia 1201 (CAL); Koderna, 3.3.1976, Banerji 3319 (CAL); Someshwar hills, 7000 ft., 13.4.1963, Thoathathri 10058 (CAL). **Daman**, Gambhirghat near Dhodara village, 12.5.1963, M.Y. Ansari 89246 (CAL). **Goa**, Porvoricum, 4.9.1963, Kanodia 89753 (CAL). **Karnataka**, Mysore, Chamundi hills, 22.9.1969, Raghavendra Rao 128 (IISc); Hassan, Nagapuri, 16.7.1969, Saldanha 14091 (IISc); Chathura Kallubetta, 18.4.1962, R.S. Rao 80059 (CAL). **Kerala**, Wyanad, Sultan's Battery to Pulpally, 1300 m, 22.8.1997, Sanjai 104944 (MH); *ibid.* 30.7.1905, Barber 7400 (CAL); Thiruvananthapuram, on route to Bonoccord, 340 m, 13.8.1995, Sanjai 104902 (MH); Idukki, Lower camp, Periyar, 27.9.1995, Sanjai 104908 (MH); Palghat, Mukkali forest, 475 m, 14.10.1965, Vajravelu 26255 (MH); Chindakki forest, 750 m, 16.10.1979, N.C. Nair 64680 (MH). **Madhya Pradesh**, Bilaspur, Kumkuri, 1.1.1965, Arora 7372 (CAL); Pali, 16.4.1965, Panigrahi 8593 (CAL); Indore, Chisal, 27.1.1967, Arora 5561 (CAL). **Maharashtra**, Thana, Tiger hill, 22.7.1968, Billore 116333 (CAL); Devighat, 31.5.1968, Billore 116091 (CAL); Wajii forest, 8.9.1964, Venkata Reddy 99115 (CAL); Jugar jungle, 12.3.1965, Pataskar 105139 (CAL). **Manipur**, Simhipara, 6000 ft., April 1882 George Watt 6484 (CAL). **Meghalaya**, Cherrapunji, 26.3.1960, Das 21336 (CAL); Barapani, 17.1.1957, Panigrahi 4773 (CAL); Khasia, 5600 ft., 14.7.1886, no coll. name 44243 (CAL).

Nagar Haveli, Altiale forest, 7.5.1963, R.S. Rao 89082 (CAL). **Nagaland**, Kenoma, Naga hills, May 1895, no coll. name 11750 (CAL). **Sikkim**, 2500 ft., Hooker s. n. (Accn No. 395753, CAL); Luchung Valley, 7000 ft., 14.9.1892, Gammie 1203 (CAL). **Tamil Nadu**, Tirunelveli, Courtallam, 420 m, 3.7.1996, Sanjai 104932 (MH); Kanniyakumari, Keeriparai to Balamore, 400 m, 20.3.1979, Henry 60778 (MH); Kamaraj, Bothaimettur, 650 m, 23.2.1992, Srinivasan 98348 (MH); Dharmapuri, Anchetty forest, Kunthu Kottai, 750 m, 26.7.1978, Vajravelu & Rajan 57986 (MH); Madurai-Kodaikanal road, 667 m, 10.3.1958, Subramanyam 5560 (MH); Coimbatore, Maruthamalai, 653 m, 5.11.1956, Sebastine 1200 (MH); Salem, Gundur road, Yercaud, 1340 m, 3.5.1965, Karthikeyan 26820 (MH); Nilgiri, Bokkapuram R.F., 1000 m, 13.18.1970, Sharma 35437 (MH). **Uttaranchal**, Garhwal, Chamoli, 1800 m, 27.5.1961, Subbarao 14850 (BSD); Almora, Siuri, 1800 m, 17.6.1923, Parker 2002 (DD); Kumaon, Kapkot, 1200-1300 m, T.A. Rao 6523 (BSD); Nainital, Haldwani, 1000 ft., 18.8.1926, Osmaston 42775 (DD); Mussoorie, Jharipani, 1500 m, 27.4.1957, T.A. Rao 2394 (BSD). **West Bengal**, Chakulia, Jan. 1881, Gamble 9210 (CAL); Hot spring, 17.11.1891, Prain s. n. (Accn No. 395744, CAL).

Viscum capitellatum Sm. in Rees, Cyclop. 37: Viscum no. 18. 1817; DC., Prodr. 4: 279. 1830; Wight & Arn., Prodr. 380. 1834; Hook.f., Fl. Brit. India 5: 225. 1886, p. p.; Trimen, Handb. Fl. Ceylon 3: 471. 1895; Gamble, Indian Timbers 584. 1902; Brandis, Indian Trees 552. 1906; T. Cooke, Fl. Pres. Bombay 2: 552. 1906, p. p.; Talbot, For. Fl. Pres. Bombay 2: 421, t. 480. 1911; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925, p. p.; C.E.C. Fischer in Rec. Bot. Surv. India 11(1): 171. 1926; Danser in Blumea 4: 309, t. 2. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 166. 1957; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 418. 1987.

Fig. 7

Semi-parasitic herbs, monoecious, evergreen, up to 15 cm long, densely branched, decussate and divaricate at lower portions of stem to more or less umbellate towards the apices; nodes swollen bearing whorl of branches; internodes terete or slightly compressed, smooth, 5-6 x 0.2-0.5 cm. *Leaves* sessile, opposite, usually present in young plants, partly normally developed, sometimes lacking entirely or reduced to scales, and at times the whole plant apparently leafless; normal leaves obovate, roundish-ovate to spatulate, subcuneate at base, rounded at apex, entire, conduplicately folded or even rolled, c. 1-2.5 x 0.5-0.9 cm, thick, sometimes coriaceous, dull green. *Inflorescence* cymose, lateral at the axils of leaves, hardly terminal at apices of the branches, up to 6 at each node; peduncles prominent, up to 3 mm long.

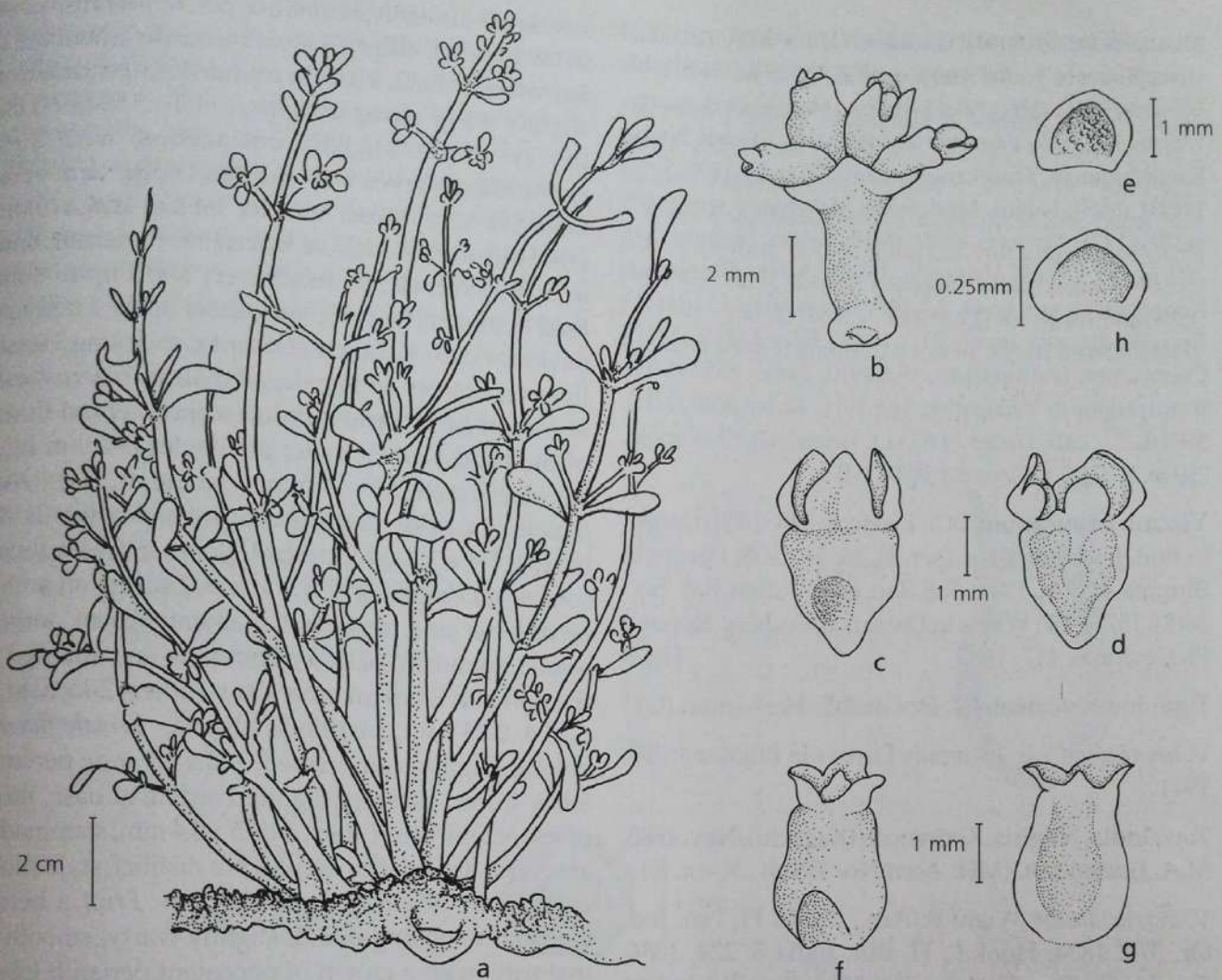


Figure 7. *Viscum capitellatum* J.E. Smith – a. Habit; b. Inflorescence; c. Male flower; d. Male flower, l. s.; e. Male perianth lobe with anther; f. Female flower; g. Female flower, l. s.; h. Female perianth lobe.

bearing a navicular bracteate cup at its apex with 3 flowers, sometimes with up to 5 flowers, the central flower being male, the laterals female, at times the male flower absent and then the whole inflorescence having only female flowers and in such cases the central female flower possessing its own bracteal cup; occasionally another inflorescence of similar nature developing at the place of the central flower with normal flower arrangements. *Male flowers* sessile, obovate, slightly compressed towards the base, c. 2×1 mm; perianth lobes 2, free, valvate, with serrate margins bearing an anther on its inner surface, c. 1.2×1.2 mm; stamens 2, sessile; anthers 2-locular, attached to the inner surface of perianth lobes, c. 0.8×0.8 mm; pistillode absent. *Female flowers* bracteolate, oblong, elongate, c. 2.5×1 mm; perianth lobes 3, free, valvate, more or less conical, c. 0.5×0.75 mm; staminodes absent; ovary inferior; ovules not distinct; style very short; stigma conical. *Fruit* a drupe, ellipsoid or ovoid, smooth, shiny green when fresh,

distinctly constricted just below the perianth bearing a rim.

Flowering & Fruiting: February - July.

Distribution: India (Karnataka, Kerala, Tamil Nadu), Sri Lanka.

Hosts: *Dendrophthoe falcata* (L. f.) Ett., *Loranthus bracteatus* Wall., *L. tomentosus* Roth and *Erythroxylon monogynum* Roxb.

Note: This is found mainly as hyperparasites on *Dendrophthoe falcata*.

Specimens Examined: **Karnataka**, Nagalari, Dharwar, Dec. 1949, Johri 111459 (DD); Bangalore, Bennarghatta road, 2.12.1978, Saldanha & Sreenath 4853 (IISc); Bennarghatta, 4.6.1975, Saldanha 18443 (IISc); North Kanara, Thumbebedu, 4.6.1981, Ramesh & Shivaprasadh 12985 (IISc); Kodagu, Arekad Kushalnagar, 4.6.1979, S.R. Ramesh & B.R. Ramesh 7956 (IISc). **Kerala**, Wayanad Dist., en route to Pulapally, 1450 m, 22.8.1997, Sanjai 104941 (MH); Kozhikode Dist., Calicut,

Idimuzhikkal, 25.5.1971, *Sivarajan* 1115 (CALI); Palakkad Dist., Bhavani bank, Attappady R.F. 525 m, 31.5.1966, *Vajravelu* 27742 (MH); Palakkad Dist., Mangalam dam area, 175 m, 2.3.1975, *Vajravelu* 46144 (MH). **Tamil Nadu**, Kanniyakumari, Thadikaramkonam, 200 m, 2.7.1996, *Sanjai* 104931 (MH); Nilgiri, Mulli forest, Attappady range, 600 m, 27.6.1974, *Vajravelu* 44988 (MH); Salem, Hoganaikkal, 260 m, 15.3.1965, *Vajravelu* 23564 (MH); Thanjavur, Kodaikkarai, sea level, 2.2.1987, *Ragupathy* 154 (MH); Kodaikadu, sea level, 21.1.1961, *Ellis* 11819 (MH); Coimbatore, Iruttupallam, 18.6.1910, *Barber* 8552 (MH); Iruttupallam to Vellapathy, 31.5.1911, *Barber* 8640 (MH); 3500 ft., 2.6.1905, *Fischer* 24 (CAL); Tirunelveli, Chellupulli, 250 m, 7.10.1971, *Vajravelu* 38904 (MH).

Viscum heyneanum DC., Prodr. 4: 278. 1830; Danser in Bull. Jard. Bot. Btzg. (ser. 3), 16: 51. 1938; Danser in Blumea 4: 301. 1941; R.S.Rao in J. Indian Bot. Soc. 36(2): 157. 1957; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 417. 1987.

Fig. 8

Type: Indiae Orientalis, *De Candolle* Herbarium (G).

V. heyneanum var. *liocarpum* Danser in Blumea 4: 305. 1941.

Type: India, Nilgiris, Koorgooch (Kaguchi), Nov. 1883, M.A. Lawson s. n. (MH: Accn No. 45849!, K - n. v.)

V. verruculosum Wight & Arn., Prodr. Fl. Pen. Ind. Or. 379. 1834; Hook.f., Fl. Brit. India 5: 224. 1886; Gamble, Indian Timbers 584. 1902; Brandis, Indian Trees 552. 1906; Talbot in For. Fl. Bombay 2: 419. 1911; Gamble, Fl. Pres. Madras 7: 1257. 1925; C.E.C. Fischer in Rec. Bot. Surv. India 11: 180. 1926; Alston in Trimen, Handb. Fl. Ceylon 6: 250. 1931.

Type: Dindigul Hills, Wight s. n. (K - n. v.).

V. orbiculatum Wight, Ic. Pl. Ind. Or. 3: 13, t. 1016. 1845; Hook.f., Fl. Brit. India 5: 224. 1886; Gamble, Indian Timbers 594. 1902; Brandis, Indian Trees 552. 1906; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925; C.E.C. Fischer in Rec. Bot. Surv. India 11: 16b. 201. 1935.

Type: Nilghiri hills, Wight s. n. (K - n. v.).

V. orientale auct. non Willd. 1806: Thw., Enum. Pl. Zey. 136. 1859 (non DC. 1830); Brandis, For. Fl. NW. & C. India 393. 1874, p. p.; Hook.f., Fl. Brit. India 5: 224. 1886, p. p.;

Semi-parasitic herbs, evergreen monoecious, up to 40 cm long or even more, much branched; branches dense and sometimes apically whorled, often decussate towards apices; internodes terete at basal regions of the plant, slightly flattened and prominently longitudinally grooved towards the upper portion, c. 4 x 0.5 cm with swollen nodes. *Leaves*

sessile or subsessile, normal, opposite, roundish ovate to obovate or elliptic to oblanceolate, attenuate to narrowed at base, acute to rounded at apex, entire or slightly wavy along margins, c. 1.5 - 3 x .6-1.5 cm, glossy above, slightly coriaceous, with 3 - 5 longitudinal nerves with a distinct network of veins. *Inflorescence* cymose, usually lateral and axillary, arising from the axils of leaves, rarely terminal, up to 5 at each node; peduncle very short up to 4 mm long or absent, bearing very short up to 2 mm long navicular cup of 2 bracts at its apex, enclosing 3 sessile flowers; flowers all female, all male or heterosexual, in case of heterosexual inflorescence, central flower of the triad always male; peduncles 0-4 mm long, angular; bracts 1.5 - 2 mm, connate at base. *Male flowers* obovoid, slightly compressed towards the base, c. 1.9 x 1.4 mm; perianth lobes 4, free, valvate, somewhat deltoid, c. 7.5 x 1 mm, bearing an anther on its inner side; stamens 4, filaments absent, anthers sessile, roundish, placed opposite to and attached to the perianth lobes on inner side; anthers 2-loculed, c. 0.25 x 0.25 mm; pistillode absent. *Female flowers* oblong, slightly compressed, c. 2 x 1.1 mm; perianth lobes 4, free, valvate, slightly cordate at base, more or less acuminate at apex, c. 0.75 x 0.4 mm; staminodes absent; ovary inferior; ovules not distinct; style short, cylindrical; stigma nipple-shaped. *Fruit* a berry, ellipsoid to oblong-ovoid, slightly warty, smooth at maturity, with a crown of persistent perianth lobes, c. 5 x 2 mm, withering off at a later stage.

Flowering & Fruiting: February-July.

Distribution: India (Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, Andaman & Nicobar Islands), Sri Lanka.

Hosts: *Punica granatum* L., *Helecteris isora* L., *Rhizophora* sp., *Memecylon umbellatum* Burm., *Mallotus philippinensis* (Lam.) Muell., *Grewia flavescens* Juss., *Syzygium jambolanum* (Lam.) DC., etc.

Note: Danser (1941) treated this species under *V. orbiculatum* and R.S. Rao (1957) under *V. verruculosum*. Both these species are here considered synonymous to *V. heyneanum*, since the distinctive features that supposedly separated them were found variable and overlapping among *V. heyneanum*, *V. verruculosum* and *V. orbiculatum*. The present authors studied live materials but could not make any distinction among the three species.

V. heyneanum var. *liocarpum* proposed by Danser based on warty or smooth fruits does not stand, as fruits in this species can be warty or smooth, depending on maturity as pointed out by R. S. Rao (1957).

The present authors discovered 3 types of inflorescences in this species and found them on one and the same plant. They are all female, all male or heterosexual. In the heterosexual inflorescence, contrary to the views of Danser (1941) and R.S. Rao (1957), the central flower was found male instead of female. This character was mentioned as a distinctive feature of *V. orbiculatum* by Gamble. Further, peduncled triads were attributed to *V. verruculosum*, but since a continuous gradation exists in the length

of peduncle, (from 0 to 4 mm) this attribute does not stand as a distinguishing character.

Specimens Examined: **Andaman & Nicobar Islands**, South Andamans, Poona Nallah, 6.9.1982, D.K. Hore 9121 (PBL). **Andhra Pradesh**, Chittoor, 3500 ft., 28.4.1918, Fischer 4319 (CAL). **Karnataka**, North Canara, 10.3.1896, Talbot 3573 (CAL); Mysore, 1850, without collector's name s. n. (Accn No. 45795, MH). **Kerala**, Kottayam, Kumarakam, up to 5 m, 4.5.1996, Sanjai 104927 (MH); Thiruvananthapuram, Kulathoopuzha, 750 m, 26.4.1996, Sanjai 104923 (MH);

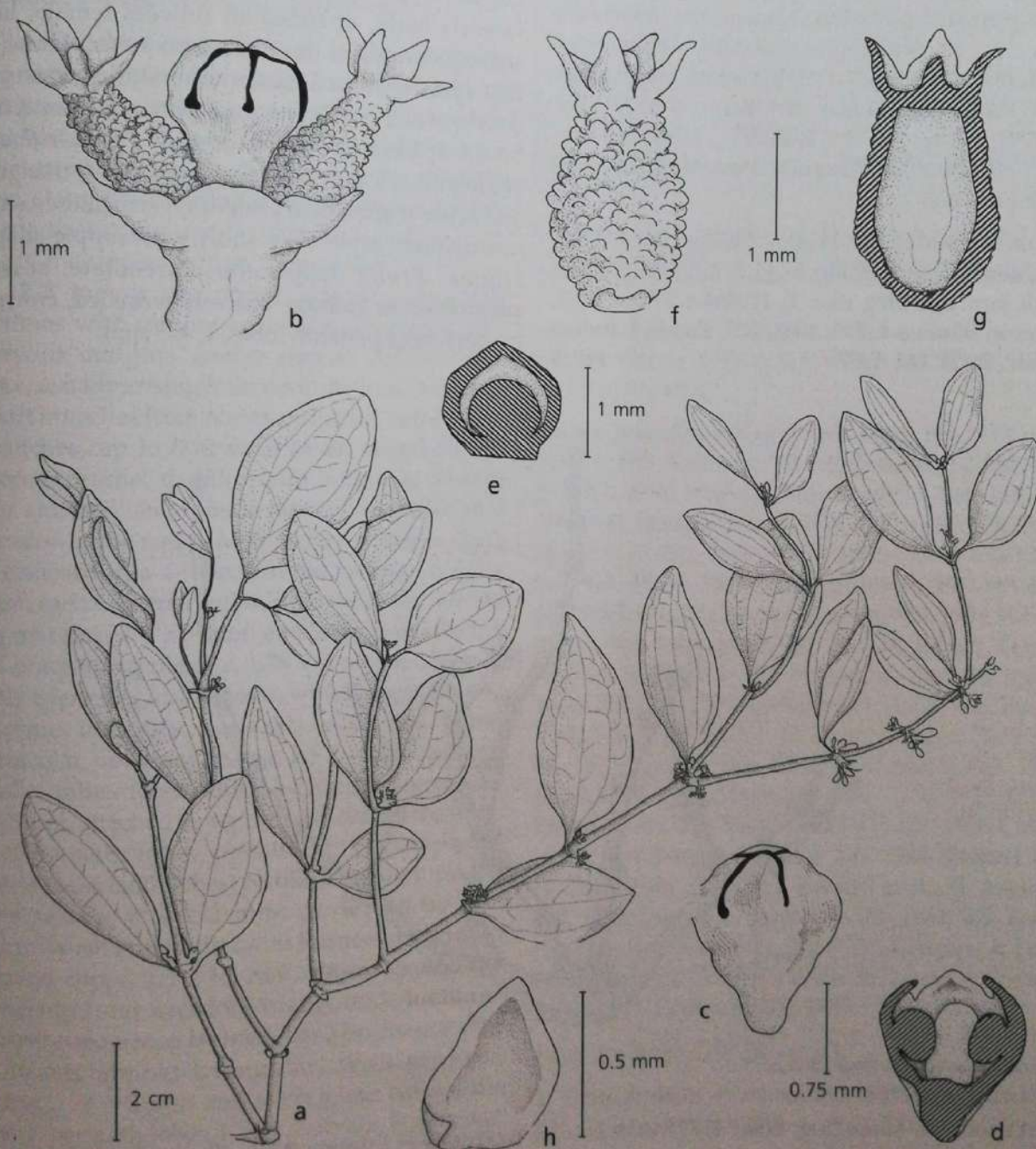
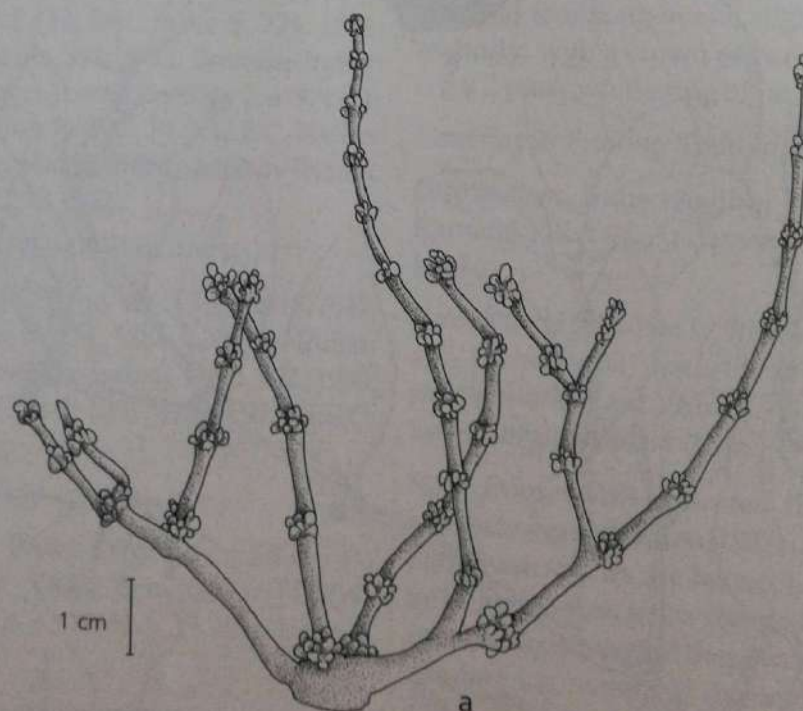


Figure 8. *Viscum heyneanum* DC. – a. Habit; b. Inflorescence; c. Male flower; d. Male flower, l. s.; e. Male perianth lobe with anther; f. Female flower; g. Female flower, l. s.; h. Female perianth lobe.

Idukki, Anjuruli, Thekkad, 900 m, 4.10.1972, Sharma 42403 (MH); Calicut, Odapallam - Chedaleth, 900 m, 14.8.1964, Ellis 19979 (MH); Trichur, Athirapally R.F., 100 m, 19.3.1966, Ramamurthy 27011 (MH). **Tamil Nadu**, Coimbatore, 2700 ft., 20.12.1905, Fischer 805 (CAL); Hassanur, 3000 ft., 9.3.1931, Jacob 179 (MH); Sadivayal, 400 m, 6.8.1960, Henry 99 (MH); South Arcot, Melpat, 28.9.1899, Barber 1082 (MH); Nilgiri Dist., Avalanche, 2000 m, 14.6.1970, Shetty 34228 (MH); Bikkatti, 5000 ft., May 1899, Gamble 20669 (MH); Bokkapuram R.F., 1025 m, 12.8.1970, Sharma 35381 (MH); Tirunelveli, lower Kannikatti, 15.7.1964, Henry 19883 (MH); Tiger falls, Mancholai, 466 m, 11.10.1957, Sebastine 4371 (MH); Kanniyakumari, on way to Sengammal estate, 500 m, 27.7.1961, Shetty 27999 (MH); Madurai, way to Sirumalai, 967 m, 25.4.1968, Subramanyam 5774 (MH); Vannathiparai, 1400 ft., 18.9.1923, Jacob 17741 (MH); Madurai Dist., Pombari Valley, Pulney hills, 15 May 1899, Bourne 1767 (MH acc. No. 45794); Pulney, July 1897, Bourne s. n. (Accn No. 395916, CAL); Coimbatore Dist., Anamalais, Punachi hill, June 1883, Gamble 12114 (CAL).

Viscum loranthe Elmer, Leaflets Philipp. Bot. 8: 3089. 1919; Merrill, Enum. Philip. Fl. Pl. 2: 113. 1923; Danser in Bull. Jard. Bot. Btzg. (Ser. 3), 11: 464. t. 27 b, c. 1931; Danser in Blumea 4: 295. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 144. 1957.

Fig. 9

Figure 9. *Viscum loranthe* Elmer - a. Habit.

Type: Luzon, Mt. Maquiling, Elmer 17777 (n. v.).

Viscum osmastonii Raizada in Indian For. 60: 537. t. 55. 1934. *Viscum* sp. Osmaston, Fl. Kumaon 465. 1927.

Type: India, Kumaon, East Almora Div., Nalia Reserve, 6000 ft., 8.1.1933, Osmaston 1536 (DD!).

Semi-parasitic herbs, monoecious, dark green found exclusively on loranthaceous members, moderately robust, up to 25 cm high; stems rigid, much branched at base, branches decussate; internodes terete, lower internodes slightly longitudinally ridged, c. 2-2.5 x 0.3x0.4 cm, becoming shorter towards the apices, the uppermost about 4-6 mm long. *Leaves* rudimentary or even absent. *Inflorescences* sessile, forming a cluster of cymes at the apex of each internode just below the node, cyme 3-flowered, sessile, subtended by a cupule, c. 0.5 mm, the central flower female, the laterals male, at times all flowers female; later subsequent cymes developing on either side of the first cyme to form a cluster around the node. *Male flowers* ovoid, c. 0.75 mm long; perianth lobes 4, free, broad at base and acute at apex. *Female flowers* oblongoid, c. 1 mm long; perianth lobes 4, triangular and acute at apex; ovary inferior, verruculose; ovules not distinct; style very short with nipple-shaped stigma. *Fruits* drupaceous, urceolate, sessile, subglobose to globose, coarsely wrinkled, crowned by persistent perianth lobes, c. 4x3 mm.

Flowering & Fruiting: May - September.

Distribution: India (Western Himalayas, Assam, Manipur), Myanmar, Malaysia.

Hosts: *Taxillus vestitus* (Wall.) Danser, *Scurrula cordifolia* (Wall.) Don, *S. pulverulenta* and *Dendrophthoe falcata* (L. f.) Ett.

Specimens Examined: **Manipur**, Kongpokpi, 3400 ft., 10.2.1954, Deb 1714 (CAL). **Uttaranchal**, Almora, 6000 ft., 8.1.1933, Osmaston 1536 (DD); Kumaon, Kherapattail, 1000 m, 10.3.1965, M.A. Rau 35350 (BSD); Dehradun, 7.7.1899, Mackinnon s. n. (Accn No. 395836, CAL).

Viscum malurianum Sanjai & N.P. Balakr., *Nordic J. Bot.* 21 (3): 267. f. 1. 2001.

Type: India, Karnataka, Malur, 850 m, near the Railway Station on *Ficus benghalensis*, 20.10.1995, Sanjai 104911 (Holotype CAL; Isotype MH).

Semi-parasitic shrubs, monoecious, leafless, light to dark green, drooping from branches and trunks of host trees; stems densely branched, basal branches dichotomous, upper ones sometimes trichotomous or even irregular, woody, brittle at nodes, slightly fibrous along the internodes, terete and wrinkled towards base, very rarely flattened and smooth towards the upper portion; internodes 1.5-3.5 cm long, 2-8 mm wide; nodes slightly swollen, sometimes with minute scale-like structures and calcareous margins. *Leaves* absent. *Inflorescence* cymose, usually arising from node, but also terminal on short branches from nodes and at the extremities of branches, up to 8 at each node, encircling it, clustered, sessile, usually with a central female flower and two lateral male flowers, enclosed in a depression at the node. *Male flowers* sessile, c. 3 x 2 mm, enclosed in a 4-lobed involucre cup, c. 1.5 x 1.5 mm, each lobe triangular, pointed at tip, serrate along margins, c. 1 x 1 mm, enclosed in another 2-lobed bracteal cupule of c. 1.75 x 2 mm; each bract slightly triangular, c. 2 x 2 mm, with some hairs and calcareous deposits; perianth lobes 4, valvate, suborbicular, obtuse at apex, c. 1.5 x 1 mm; stamens 4, sessile, anther lobes united, without interstitium, c. 1x0.5 mm, attached along the back side to the inner side of perianth lobes, opening by pores, placed opposite to perianth lobes; pistillode absent. *Female flowers* sessile, c. 4 x 2 mm, protected by two consecutive coverings, the outer formed of a 4-lobed involucre cup, c. 1.5 x 1.5 mm, almost flower-like with a central seat, each lobe triangular, c. 1 x 1 mm; the upper cup formed by fusion of 2 bracts, c. 2 x 2.5 mm; bracts almost triangular, with grooved margins, c. 2 x 2 mm and with some calcareous deposits; perianth lobes 4, free, valvate, triangular, ovate, acuminate at apex, c. 0.75 x 0.5 mm; ovules staminodes absent; ovary inferior, c. 2 x 1 mm; fruit a berry, not distinct; style short; stigma round.

globose to ovoid, c. 3-5 mm in diameter with persistent bracteal cup.

Flowering & Fruiting: March-July.

Distribution: India (Karnataka), endemic.

Note: This species is so far reported only from the type locality. It is allied to *V. ramosissimum* but differs from it as shown below:

<i>V. ramosissimum</i>	<i>V. malurianum</i>
Branches slender and weak	Branches thick and strong
Inflorescences lateral at two sides of the node	Inflorescences placed around the nodes
Female flowers c. 1.75 x 0.75 - 1 mm	Female flowers c. 4 x 2 mm
Male flowers 1 - 1.25 x 1 - 1.25 mm	Male flowers c. 3 x 2 mm
Fruits without persistent bracteal cup	Fruits with persistent bracteal cup

Specimens Examined: **Karnataka**, Malur, 850 m, near the Railway Station on *Ficus benghalensis*, 20.10.1995, Sanjai 104911 (CAL, MH).

Viscum monoicum Roxb. [Hort. Beng. 105. 1814, *nom. nud.*] ex DC., Prodr. 4: 278. 1830; Roxb., Fl. Ind. (ed. 2) 3: 763. 1832; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 379. 1834; Brandis, For. Fl. NW. & C. India 393. 1874; Hook. f., Fl. Brit. India 5: 224. 1886; Clarke in J. Linn. Soc. Bot. 25: 64. 1889; Trimen, Handb. Fl. Ceylon 3: 471. 1895; Gamble, Indian Timbers 584. 1902; Burkill in Rec. Bot. Surv. India 4(4): 77, 129. 1904; T. Cooke, Fl. Pres. Bombay 2: 552. 1906, p. p.; Brandis, Indian Trees 552, 716. 1906; Gamble in J. Asiat. Soc. Bengal 75(2): 386. 1904; Duthie, Fl. Upper Ganget. Plain 3(1): 68. 1915; Haines, Bot. Bihar & Orissa 5: 803. 1924; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925; C.E.C. Fischer in Rec. Bot. Surv. India 11(1): 161. 1926; Cowan in Rec. Bot. Surv. India 11(2): 221. 1928; Kanjilal, For. Fl. Philibit etc. 319. 1933; Kanjilal et al., Fl. Assam 4: 118. 1940; Danser in Blumea 4: 305. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 160. 1957; Grierson & Long, Fl. Bhutan 1(1): 150. 1983; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 420. 1987.

Type: Roxburgh 1181 (K - n. v.).

V. falcatum Wall. [Cat. no. 492. 1829, *nom. nud.*] ex DC., Prodr. 4: 278. 1830.

Type: India, Mont. Pundua, Wallich s. n. (G-microfish!).

V. confertum Roxb. [Hort. Beng. 105. 1814, *nom. nud.*] Fl. Ind. (ed. 2), 3: 764. 1832; (ed. 3), 715. 1874.

V. benghalense Roxb. ex Wight & Arn., Prodr. 379. 1834.

V. orientale auct. non Willd.: Talbot, For. Fl. Bombay 2: 421. 1911.

Semi-parasitic shrubs, monoecious, evergreen, 30-75 cm long, drooping from the branches and trunks of the host, pale green and slightly yellowish when dry, much branched, a pair of prophylls, usually indistinct, present at the base of every branch, decussate towards base and dichotomous towards apices; internodes terete, 3-7 cm long, 2-5 mm wide, usually smooth, sometimes longitudinally ribbed; nodes swollen. *Leaves* normal, subsessile, opposite, asymmetric, elliptic to lanceolate, slightly falcate, acute to attenuate at base, acute or subacuminate at apex, 5-10 x 1-3 cm, thinly coriaceous, entire, or wavy along margins, dull or slightly shiny; nerves curvinervous, palmately 5-nerved from the base. *Inflorescences* cymose at axils of leaves, aggregated at nodes, up to 6 at each node, sessile or subsessile; peduncle up to 2 mm long, bearing a boat-shaped pair of connate acute bracts of 1 mm long at its apex, enclosing a cluster of 3 flowers, the central one male, the laterals female or all female. *Male flowers* sessile, oblong, compressed below, c. 2 x 1 mm; perianth lobes 4, free, valvate, slightly cordate at base and apiculate at apex, c. 1.25 x 1 mm, bearing an anther on its inner surface; stamens 4, sessile; anthers 2-loculed, placed opposite to and attached to the inner side of perianth lobes; pistillode absent. *Female flowers* clavate or obovate, attenuate to nearly rounded at base, c. 2.5 x 1 mm; perianth with 4 erect, free, valvate, short triangular lobes, c. 1 x 0.75 mm; staminodes absent; ovary inferior; ovules not distinct; style short; stigma capitate. *Fruits* usually ellipsoid, oblong, attenuate to round at base, truncate at apex, c. 4-6 x 2-3 mm, green, glossy, distinctly smooth.

Flowering & Fruiting: Almost throughout the year, mainly during May - September.

Veracular name: Pullurivi (Tamil).

Distribution: India (northeast-central-west-southwards to southern India), Bhutan, Sri Lanka.

Uses: The leaves of plants parasitising *Strychnos nux-vomica* trees possess poisonous properties (Wealth of India - Raw Materials, 1976). They are dried and used as a substitute for the medicinal chemicals, strychnine and brucine, obtained from *Strychnos* trees.

Note: R.S. Rao (1957), probably due to lack of fresh collections, classified this species in a group along

with that of *V. orientale* Willd. on the basis that in both the central flower of the triad was female. Instead, J.D. Hooker (1886) correctly pointed out that the plant had a central male flower in the triad or sometimes absent. This feature was evident in the collections made by the first author.

Hosts: *Macaranga indica* L., *Meyna spinosa* Roxb. ex Link., *Murraya koenigii* (L.) Spreng., *Atalantia monophylla* (L.) DC., *Zizyphus oenoplia* Miller, *Pongamia glabra* Vent., *Acacia caesia* (L.) Willd., *Albizia odoratissima* (L. f.) Benth., *Albizia amara* (Roxb.) Boiv., *Punica granatum* L., *Adina cordifolia* (Roxb.) Brandis, *Schrebera swietenoides* Roxb., *Wrightia tinctoria* (Roxb.) R. Br., *W. tomentosa* (Roxb.) Roem. & Schult., *Strychnos nux-vomica* L. and *Santalum album* L.

Specimens Examined: **Andaman & Nicobar Islands**, South Andamans, Nilambur, 10 m, 22.7.1975, Bhargava 2473 (CAL, PBL); near Shoal Bay, sea level, 16.3.1976, Balakrishnan & Bhargava 3626 (PBL). **Andhra Pradesh**, Chittoor, 3500 ft., 28.4.1918, Fischer 4319 (CAL). **Assam**, Chaga hill, March 1899, Prain 742 (CAL); Katakhal R.F., 1.9.1957, R.S. Rao 9078 (CAL). **Bihar**, Duli forest, 20.11.1964, Kanodia 1303 (CAL); Sonapi, 3.1.1961, Subbarao 23134 (CAL); Hyarbagh, 24.11.1891, Prain s. n. (CAL herb. Accn no. 70830). **Karnataka**: Hassan, Chikkanahalli-Archalli road, 900 m, 7.8.1970, Saldanha & Ramamoorthy 470 (IISc); Dharwar, April 1918, Bell 3889 (DD); North Kanara, Sampkhand, 1600 ft., October 1904, Talbot 780 (CAL). **Kerala**, Idukki, Thankakanam estate, Vagamun, 1100 m, 20.2.1996, Sanjai 104919 (MH); Udumbancholai, 5000 ft., Dec. 1910, Meebold 13039 (CAL); Wyanad, Kalpetta, 1200 m, 21.8.1997, Sanjai 104939 (MH); Palghat, Siruvani western slopes, 625 m, 29.5.1979, Vajravelu 62865 (MH). **Madhya Pradesh**, Bilaspur, Ghagra, 23.4.1965, Arora 8930 (CAL). **Manipur**, Rongtang, 14.3.1838, Biswas 4810 (CAL). **Meghalaya**, Khasi, 3000 ft., Thomson s. n. (Accn No. 395954, CAL). **Orissa**, Keonjargarh, 7.7.1957, Panigrahi 8703 (CAL); Chakala, 21.2.1958, Panigrahi 12689 (CAL); Rebnapalaspal, 30.6.1957, Panigrahi 8451 (CAL); Bharaj Bossa, 2600 ft., 13.2.1958, Panigrahi 12265 (CAL); Daringbad, 2.2.1900, Barber 1361 (MH). **Mizoram**, Aijal, protected forests, 3500 ft., 11.1.1963, Deb 30511 (CAL). **Sikkim**, without exact locality, 2400 ft., Hooker s. n. (CAL herb. Accn no. 395957). **Tamil Nadu**, Coimbatore, 2000 ft., 1.8.1903, Fischer 103 (CAL); Kowattiyasi, 2350 ft., 25.9.1916, Fischer 4000 (CAL); Nilgiri hills, Gudalur, 3000 ft., 9.11.1890, Barber s. n. (MH herb. Accn no. 45973); Madras, Rangi hill, 2000 ft. Feb. 1883, Gamble 16012 (DD); Tirunelveli, Mancholai, 1066 m, 17.10.1957, Sebastine 4530 (MH). **Tripura**, Agartala, 500-800 ft., 30.12.1914, Debbarman 511 (CAL); Pungchen, 7.7.1961, Deb 26569 (CAL). **West Bengal**, Lohadigga, 2000 ft., Nov. 1880, Gamble 8711 (CAL); Chota Nagpur, 1000 ft., 9.4.1884, Clarke 34631 (CAL).

Viscum mysorensense Gamble in Kew Bull. 329. 1925 & in Fl. Pres. Madras 7: 1257, 1259. 1925; Danser in Blumea 4: 279. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 125. 1957.

Type: South India, Mysore, Arisikere, 600 m, Feb. 1908, Meebold 8207 (K-Photograph!).

Fig. 10

Semi-parasitic herbs possessing a golden yellow colour on all parts; stems slender, over 50 cm long, dichotomously or trichotomously branched at nearly all the nodes, basal portion terete, 5-6 cm long, up to 3 mm thick, longitudinally wrinkled, hardly striped, slightly thickened at the nodes, the young internodes

usually 2.5-4 cm long, distinctly longitudinally striped with shallow grooves, nearly terete, or slightly flattened near the base, 1-1.5 mm broad, strongly alternately flattened and double-edged towards the apex, 2-3 mm broad. Leaves of two types, the larger leaves normally developed only at some node, the largest leaf obtusely lanceolate to spatulate, up to 4x1 cm in size, often smaller, rounded at apex, decurrent into a short petiole, rather thickly coriaceous, with 3 longitudinal nerves, more distinct above than beneath and connected by indistinct veins; petioles abaxially rounded and adaxially flat or canaliculate; the scale-like leaves appearing at most

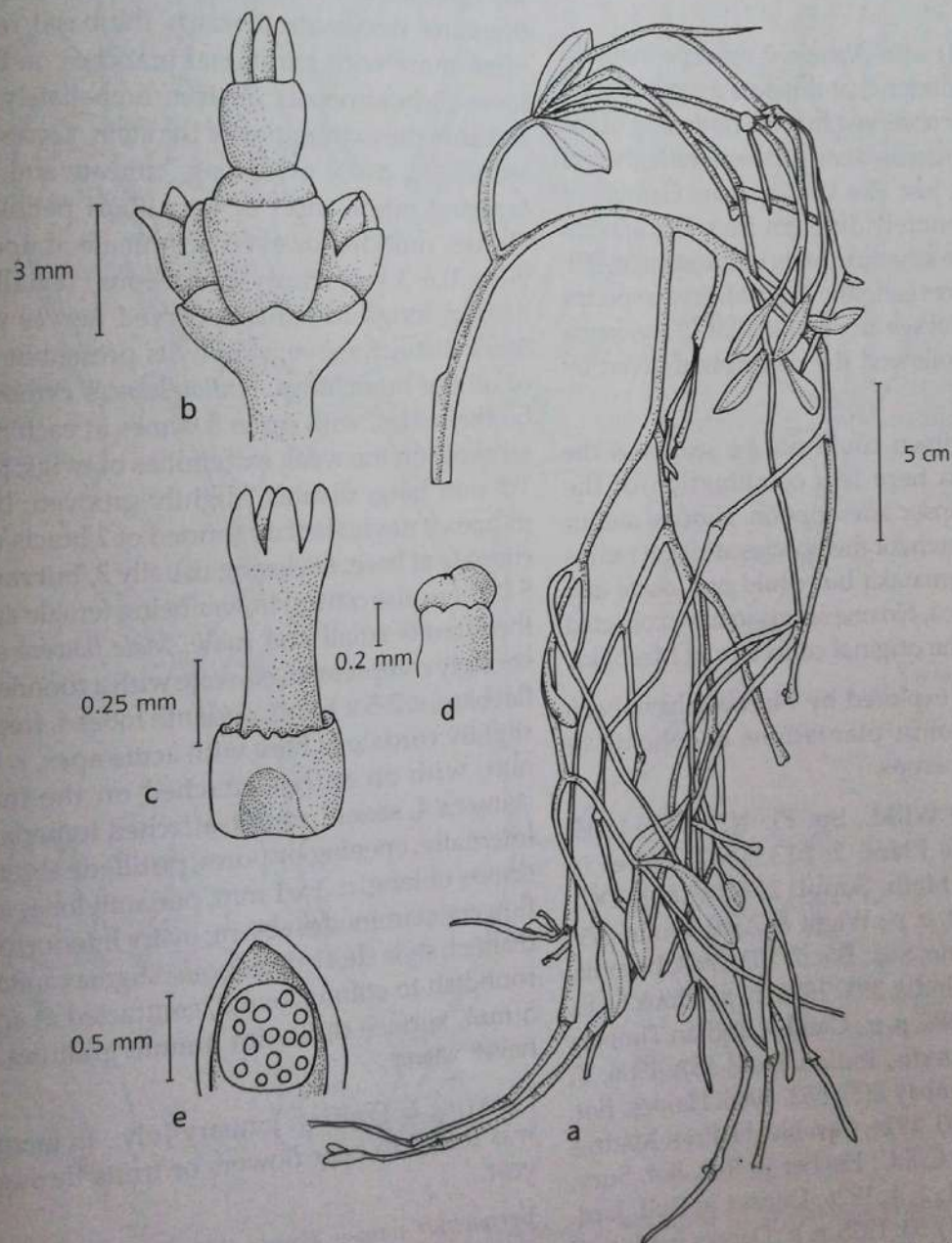


Figure 10. *Viscum mysorensense* Gamble – a. Habit; b. Inflorescence; c. Female flower; d. Style and stigma; e. Male perianth lobe with anther.

of the nodes, nearly 0.5 mm long, acute; prophylls 2 in number, noticed at the bases of all ramifications. *Inflorescences* rarely terminal, usually axillary or at both sides of the axillary ones, sessile or shortly pedunculate, 1-3-flowered cymes; peduncle flattened, up to 1 mm long and broad, bearing at its apex 2 opposite acute bracts forming together a navicular cup up to 2 mm long, each bearing one sessile flower in its axil, devoid of a bracteal cup and usually male, rarely female, nearly 1 mm long and compressed between the bracts and the middle flower; the middle flower female, rarely sessile and without bracteal cup, usually very shortly pedicellate and surrounded by a cup composed of two small bracts alternating with those of the lower pair. *Fruits* unknown.

Distribution: Known only from the type locality in India.

Note: Danser (1941) who examined the type material at Kew held the opinion that this was a very distinct species. He further observed that the flattening of the articulations was intermediate between the leafy and the leafless forms, just like *Viscum wrayi* Gamble of Malaya, but was entirely different from this species and its allies by the structure of its inflorescence. R.S. Rao (1957), while revising the Indo-Malayan species of *Viscum*, could not see any material of *V. mysorens* Gamble, and he followed the description given by Danser (1941).

The original specimen could not be seen and the description given here is a combination of the protologue and Danser's description. The first author made intensive search for this species at 10 km radius of Arisikere in Karnataka but could not locate any Viscaceae in the area. No one seems to have collected this species after the original collection of Meebold.

Most of the areas explored by Meebold have been converted to coconut plantations and fields of *Sorghum* and other crops.

Viscum orientale Willd., Sp. Pl. 4(2): 737. 1805; Persoon, Synopsis Plant. 2: 613. 1807; Poirer in Lamarck, Encycl. Meth. Suppl. 2: 860. 1811; DC., Prodr., 4: 278. 1830, p. p.; Wight & Arn., Prodr. 379. 1834; Oliver in J. Linn. Soc., Bot. 7: 103. 1864; Brandis, For. Fl. NW. & C. India 393. 1874, p. p.; Hook.f., Fl. Brit. India 5: 224. 1886, p. p.; Gamble, Indian Timbers 584. 1902, p. p.; Brandis, Indian Trees 552. 1906; T. Cooke, Fl. Pres. Bombay 2(3): 552. 1906; Haines, Bot. Bihar & Orissa 5: 803. 1924; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925; C.E.C. Fischer in Rec. Bot. Surv. India 11(1): 161, t. 1, 2, 4. 1926; Danser in Bull. Jard. Bot. Btzig. ser. 3, 16(1): 53. 1938, p. p.; Danser in Blumea 4: 299. 1941; Wiens in Dassan. & Fosberg, Revised Fl.

Ceylon 6: 419. 1987.

Fig. 11

Type: Indiae Orientalis, Willdenow 18293 (BD - Microfiche!).

Viscum verticillatum Roxb. [Hort. Beng. 105. 1814, nom. nud.] Fl. Ind. ed. 2: 764. 1832 & ed. 3: 715. 1814.

Type: Wallich 491C (K).

Viscum verruculosum auct. non Wight & Arn. 1834; Talbot, For. Fl. Bombay 2: 419. 1911, p. p.

Semi-parasitic herbs, monoecious dark green, up to 50 cm long and rarely more, bushy in appearance, with strongly branched stem, the lower internodes terete and sometimes slightly striped, up to 6 cm long, c. 6 mm thick, internodes generally terete, somewhat angular and reduced in diameter and length towards the apices, 2-3 cm long, 2-3 mm wide; nodes swollen, branches decussate towards the basal region, but often more with additional branches on the nodes, more dichotomously or even umbellately arranged towards the extremities of the stem. *Leaves* opposite, subsessile, ovate or oblong, cuneate and distinctly tapering into a short or very short petiole at base, obtuse, rounded or even acuminate at apex, entire, 2-6 x 0.6-3 cm, thinly coriaceous, usually with 3 distinct longitudinal and curved nerves which are more distinct above; prophylls present at the bases of all the branchings. *Inflorescences* cymose, lateral on the nodes, with up to 8 cymes at each node, also terminal on the weak extremities of twigs; peduncles 1-5 mm long, distinct, slightly grooved, bearing at its apex a navicular cup formed of 2 bracts which are connate at base, enclosing usually 3, but rarely up to 5 flowers, the central flower being female and larger, the laterals small and male. *Male flowers* short and strongly compressed, obovate with a rounded or even flat base, c. 2-5 x 1 mm; perianth lobes 4, free, valvate, slightly cordate at base with acute apex, c. 0.9 x 0.75 mm, with an anther attached on the inner side; stamens 4, sessile, round, attached to perianth lobes internally, opening by pores, pistillode absent. *Female flowers* oblong, c. 3 x 1 mm, perianth lobes as in male flowers; staminodes absent; ovary inferior; ovules not distinct; style short, deciduous; stigma capitate. *Fruits* roundish to oblong, ovoid, contracted at apex, c. 6 x 5 mm, surface dull with minute granules, smooth, never warty.

Flowering & Fruiting: January-July. In many areas it was found to bear flowers or fruits throughout the year.

Vernacular names: Banda (Hindi), Chandra badamika, Sundara badanika (Telugu), Banda (Santhal), Pilluli (Tamil).

Distribution: India (North-east to the Peninsula, central India, southwards Andaman & Nicobar Islands), Sri Lanka.

Chromosome number 10-13 (Schaeppei & Steindl, 1945 Barlow & Wiens, 1971).

Hosts: *Albizia amara* (Roxb.) Boiv., *Excoecaria agallocha* L., *Pongamia pinnata* (L.) Pierre, *Securinega virosa* (Willd.) Baill., *Strychnos nux-vomica* L., *Wrightia tinctoria* (Roxb.) R. Br., *Grewia tiliaefolia* Vahl, *Helecteris*

isora L., *Capparis sepiaria* L., *Shorea tumbagata* Roxb., *Citrus decumana* (L.) L., *Zizyphus oenoptia* Miller, *Scutia myrtina* (Burm.) Kurz, *Aphania bifoliata* (Thw.) Radlk., *Lepisanthes tetraphylla* (Vahl) Radlk., *Monigera indica* L., *Acacia caesia* (L.) Willd., *Albizia odoratissima* (L. f.) Benth., *Memecylon umbellatum* Burm., *Punica granatum* L., *Gardenia gummifera* L. f., *Diospyros ebenum* Koenig., *Cryptolepis grandiflora* Wight, *Decalepis hamiltoniana* Wight & Arn., *Elaeagnus latifolia* Bodd., *Santalum album* L., *Cleistanthus collinus* (Roxb.) Benth. ex Hook. f.,

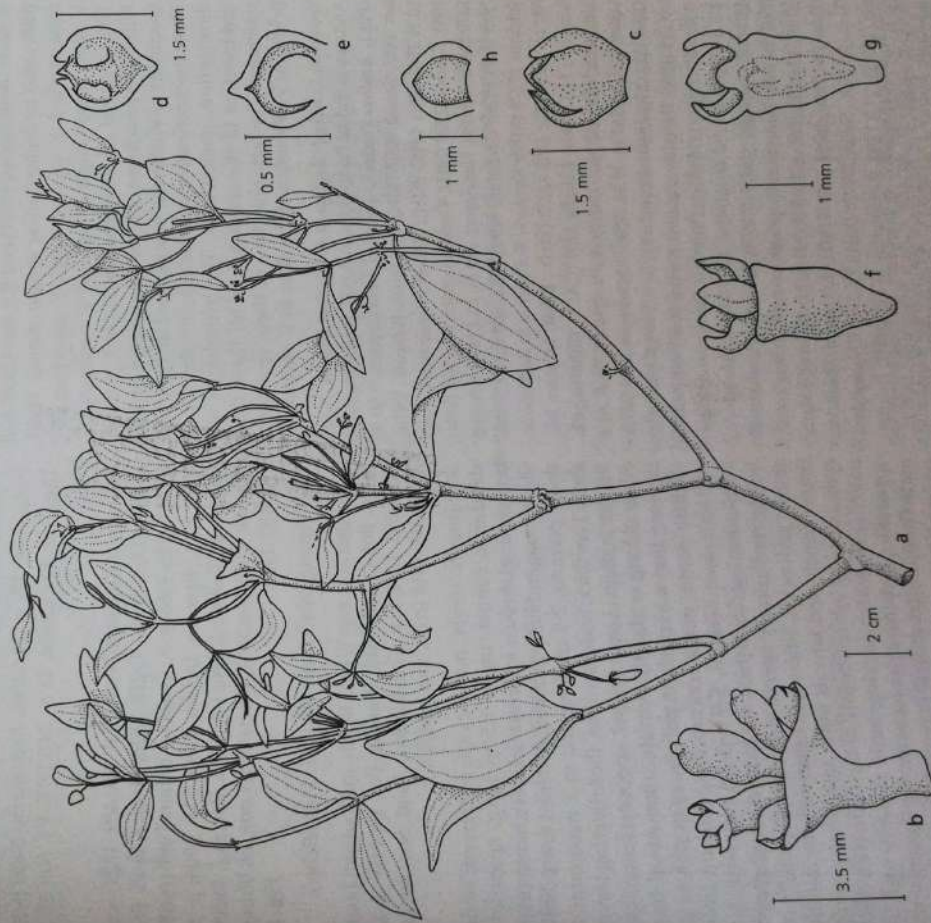


Figure 11. *Viscum orientale* Willd. - a. Habit; b. Inflorescence; c. Male flower; d. Male flower; e. Male perianth lobe with anther; f. Female flower; g. Female flower; h. Female perianth lobe.

Flueggea leucopyrus Willd., *Flueggea microcarpa* Blume, *Putranjiva roxburghii* Wall., *Mallotus philippensis* (Lam.) Muell.

Occasionally it parasitizes on other Loranthaceae species.

Note: Plants parasitising on *Strychnos nux-vomica* are used in India as a substitute for *nux-vomica*. A poultice of leaves is used for neuralgia. Plants are burnt and ashes rubbed on the body for treatment of itches. They are used in earache. An unnamed alkaloid has been reported from the plant (Wealth of India - Raw Materials, 1976).

Remarks: Both Danser (1941) and R.S. Rao (1957) had difficulties in distinguishing *Viscum orientale* Willd. from its allied *V. heyneanum* DC., *V. ovalifolium* DC., *V. verruculosum* Wight & Arn. and *V. monoicum* DC. They grouped all these species under *V. orientale* Willd. The protologue of *V. orientale* is based on three specimens of Willdenow bearing the Cat. no. 18293. These specimens carry the same note, or rather a short description, pasted to it. The protologue is a combination of the characters of all these three specimens. In fact, only two of these specimens belong to *V. orientale* and the other to *V. monoicum*.

Specimens Examined: **Andaman & Nicobar Islands**, North Andamans, Saddle Peak, 400 m, 31.3.1977, Balakrishnan 5390 (PBL). **Andhra Pradesh**, Godavari, Venkataparath, 5000 ft., Jan. 1887, Gamble 18565 (MH); Cuddapah, Balapalle, 250 m, 10.11.1962, Ellis 14983 (MH); Nellore, Racupattam, Aug. 1883, Gamble 12380 (MH); Visakhapatnam, 8.5.1900, Barber 1570 (MH); Medak, Narasapur, 710 m, 24.4.1959, Sebastine 7979 (MH); East Godavari, Kuttraveda, 600 m, 20.5.1966, Subbarao 27275 (MH); Kurnool, Rollapenta to Pecheravee, 700 m, 16.8.1972, Ellis 42273 (MH). **Bihar**, Murram hill, Rangarh, 14.11.1964, Kanodia 1200 (CAL). **Chhattisgarh**, Bailadilla, near Raipur, 10.2.1963, Panigrahi 6755 (CAL); Bastar, Keskul, 567 m, 17.11.1958, Subramanyam 7123 (MH). **Karnataka**, Mysore, Kukkunahally, 18.10.1969, Raghavendra Rao 219 (IISc); Bangalore, museum road, 16.6.1980, Ramesh & Gurudev Singh 11596 (IISc); Thumkur, Devarayana Durga, 14.7.1978, Ravindra & Ramesh 1514 (IISc); Mandeya, Malavalli - Kollegal road, 31.7.1979, Ramesh & Manohar 8610 (IISc). **Kerala**, Thiruvananthapuram, en route to Bonocord, 380 m, 13.8.195, Sanjai 104903 (MH); Idukki, Vellikulam, 900 m, 19.2.1996, Sanjai 104918 (MH); Kottayam, Keezhoor, 300 m, 4.5.1996, Sanjai 104928 (MH); Trichur, Chimini dam area, 175 m, 21.3.1980, Ramamurthy 66238 (MH); Palghat, 500 ft., 27.1.1910, Fischer 1707 (CAL); Attappady, 1400 ft., 11.2.1910, Fischer 1743 (CAL). **Maharashtra**, Without locality, 5.3.1896, Talbot 3573 (DD). **Orissa**, Sukinola, 23.6.1957, Panigrahi 8287 (CAL); Ghatgaon, 23.6.1957, Panigrahi 8413 (CAL); Ganjam, Kaliyaguda, 500 ft., Feb. 184,

Gamble 13837 (CAL); Chamudya, 19.8.1931, Narayanaswami 5861 (MH); Tikkapalli to Linepada, 23.1.1900, Barber 1205 (MH). **Tamil Nadu**, Nilgiri, Kunjapanai slopes, 600 m, 10.8.1970, Vajravelu 35281 (MH); Coimbatore, Mettupalayam, 17.8.1910, Meebold 8549 (CAL); Kurudimalai, northern slopes, 800 m, 6.8.1956, Subramanyam 485 (MH); Dharmapuri, Kudigere, Kodagarai, 19.12.1990, Ravishankar 84181 (MH); Madurai, Sirumalai, 266 m, 18.2.1958, Subramanyam 5351 (MH); Anna, Sattiar, 600 m, 19.6.1986, Ramamurthy 83846 (MH); Tirunelveli, Mundanthurai, 14.5.1901, Barber 2786 (MH); Ramanathapuram, Thiruppathur, 250 m, 29.11.1977, N.C. Nair 52923 (MH); Salem, Hoganaikkal, Chinnar bank, 275 m, 14.7.1964, Vajravelu 20619 (MH); Tiruchirapalli, Narathamalai, Pudukkottai, 125 m, 22.6.1965, Ramamurthy 23690 (MH); Thanjavur, Kodaikanal, 25 m, 24.5.1978, V.J. Nair 57074 (MH).

***Viscum ovalifolium* Wall.** [Cat. no. 489. 1829, *nom. nud.*] ex DC., Prodr. 4: 278. 1830; Hook.f. in Fl. Brit. India 5: 225. 1886, *p. p.*; Gamble, Indian Timbers 584. 1902, *p. p.*; Brandis, Indian Trees 552. 1906, *p. p.*; Danser in Blumea 4: 296. 1941; R.S. Rao in J. Indian Bot. Soc. 32(2): 146. 1957; Grierson & Long, Fl. Bhutan 1(1): 150. 1983.

Fig. 12

Type: Penang, Wallich 489 (K, CAL-Microfiche!).

V. orientale auct non Willd.: Benth. in Hooker's Lond. Journ. Bot. 2: 222. 1843; Brandis, For. Fl. NW. & C. India 393. 1874, *p. p.*; Gamble in J. Asiat. Soc. Bengal 75(2): 386. 1914 (cum. var. *ovalifolium*).

Semi-parasitic shrubs, monoecious, evergreen; stems slender to robust, up to 1.5 m long, sparingly branched, glabrous; internodes terete, sometimes slightly longitudinally grooved, flattened towards the apical portions, 2-5 cm long and to a maximum of about 1 cm thick; nodes swollen, those bearing leaves 3-6 mm in diam. **Leaves** normal, opposite, lanceolate, ovate, oblong or slightly obovate, attenuate at base tapering into a very short petiole, apex obtuse or slightly acute, entire, coriaceous, dull on both surfaces, inequilateral, 5-9 x 2-3.5 cm, with 3-5 longitudinal nerves, which are more distinct above. **Inflorescences** usually lateral, at first single, sessile or shortly peduncled, 3-flowered cyme with the middle flower female and laterals male, later similar such cymes develop adventitiously at the node encircling it, most of which lacking male flowers and in appearance look like a cluster of female flowers with male flowers distributed here and there; flowers enclosed in a navicular cup of bracts about 2 mm long. **Male flowers** sessile, compressed longitudinally, about 1 mm long; perianth lobes 4, free, triangular with anthers attached on inner surface; stamens 4, sessile;

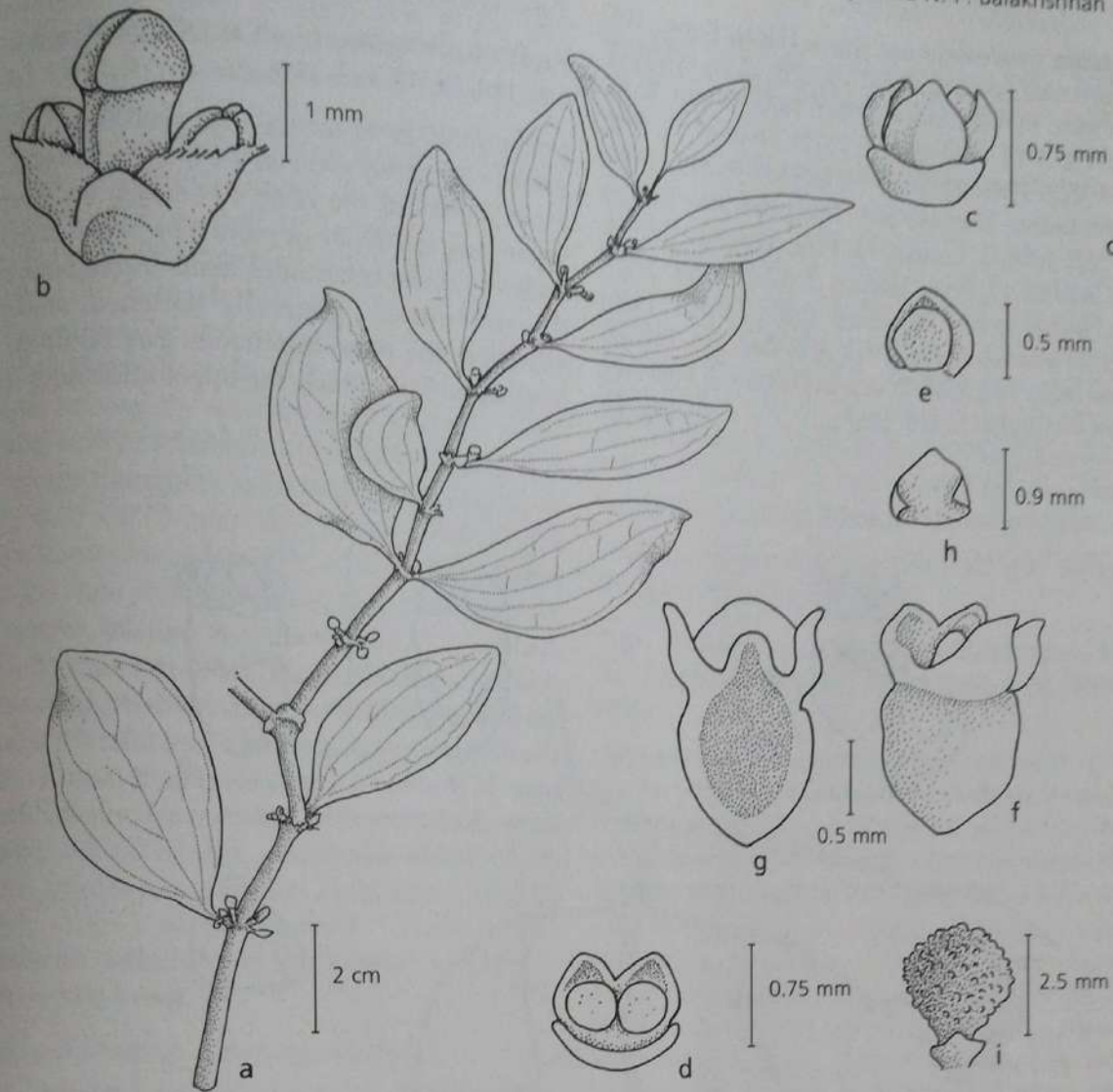


Figure 12. *Viscum ovalifolium* Wall. ex DC. – a. habit; b. inflorescence; c. male flower; d. male flower, l. s.; e. male perianth with anther; f. female flower; g. female flower, l. s.; h. female perianth lobe; i. fruit.

anthers attached to tepals, opening by pores; pistillode absent. Female flowers oblong, 1.5–2 mm long, sessile; perianth lobes 4, free, triangular; ovary inferior, warty; ovules not distinct; style short, conical; stigma capitate. Fruits roundish to ellipsoidal, somewhat contracted at base, distinctly warty till ripening, c. 5–6 × 4 mm, covered by slightly enlarged conical style.

Flowering & Fruiting: January–April.

Distribution: India [Andaman & Nicobar Islands (a new record), Assam and Manipur states], Bhutan, Myanmar, Hongkong, Malesia, up to Australia (Queensland).

Chromosome number $n = 11$ (Barlow, 1964)

Host: *Quercus incana* Roxb.

Note: This species was under doubtful status as it was treated as a larger form of *V. orientale*. Hooker, while treating this as a separate species has expressed his doubt as to whether this was a larger form of *V. orientale* or not. However, this species can be distinguished from *V. orientale* by its sessile to subsessile inflorescences and warty globular young fruits. Previously, this species was not known within the political boundary of India. R.S. Rao (1957) reported it for the first time from Assam and Manipur.

Specimens Examined: Andaman & Nicobar Islands, South Andaman, Shoal Bay, sea level, 16.3.1976, Balakrishnan & Bhargava 3617 (PBL). Manipur, Kongpokpi, 10.2.1954, Deb 1712 (CAL); Longapole, 21.1.1953, Prasanthi 664 (CAL); Kaupro hill, 6000 ft., 19.12.1953, Deb 1499 (CAL).

13. *Viscum ramosissimum* Roxb. [Hort. Beng. 105. 1814, *nom. nud.*] ex DC., Prodr. 4: 278. 1830; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 380. 1834; Wight, Icon. Pl. Ind. Or. 3: 13. 1845 (excl. t. 1017); Hook.f., Fl. Brit. India 5: 225. 1886; Trimen, Fl. Ceylon 3: 472. 1895; Gamble, Indian Timbers 584. 1902; Brandis, Indian Trees 552. 1906; T. Cooke, Fl. Pres. Bombay 2: 554. 1906; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925; C.E.C. Fischer in Rec. Bot. Surv. India 11: 161. 1926; Danser in Blumea 4: 294. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 142. 1957; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 416. 1987.

Fig. 13

Type: Wallich Cat. 6876 (K, CAL-Microfiche!).

Aspidixia ramosissima (Wall. ex DC.) van Tiegh. in Bull. Soc. Bot. Fr. 43: 193. 1896.

Semi-parasites herbs, monoecious, pendulous, yellowish green, very rarely erect on the branches as well as on main trunks of the host; stems slender, branches numerous, decussate or more than two at each node; nodes swollen; internodes terete throughout except the extremities, generally flattened, smooth or wrinkled, the basal internodes may be up to 5 cm long, up to 5 mm thick, the upper internodes shorter

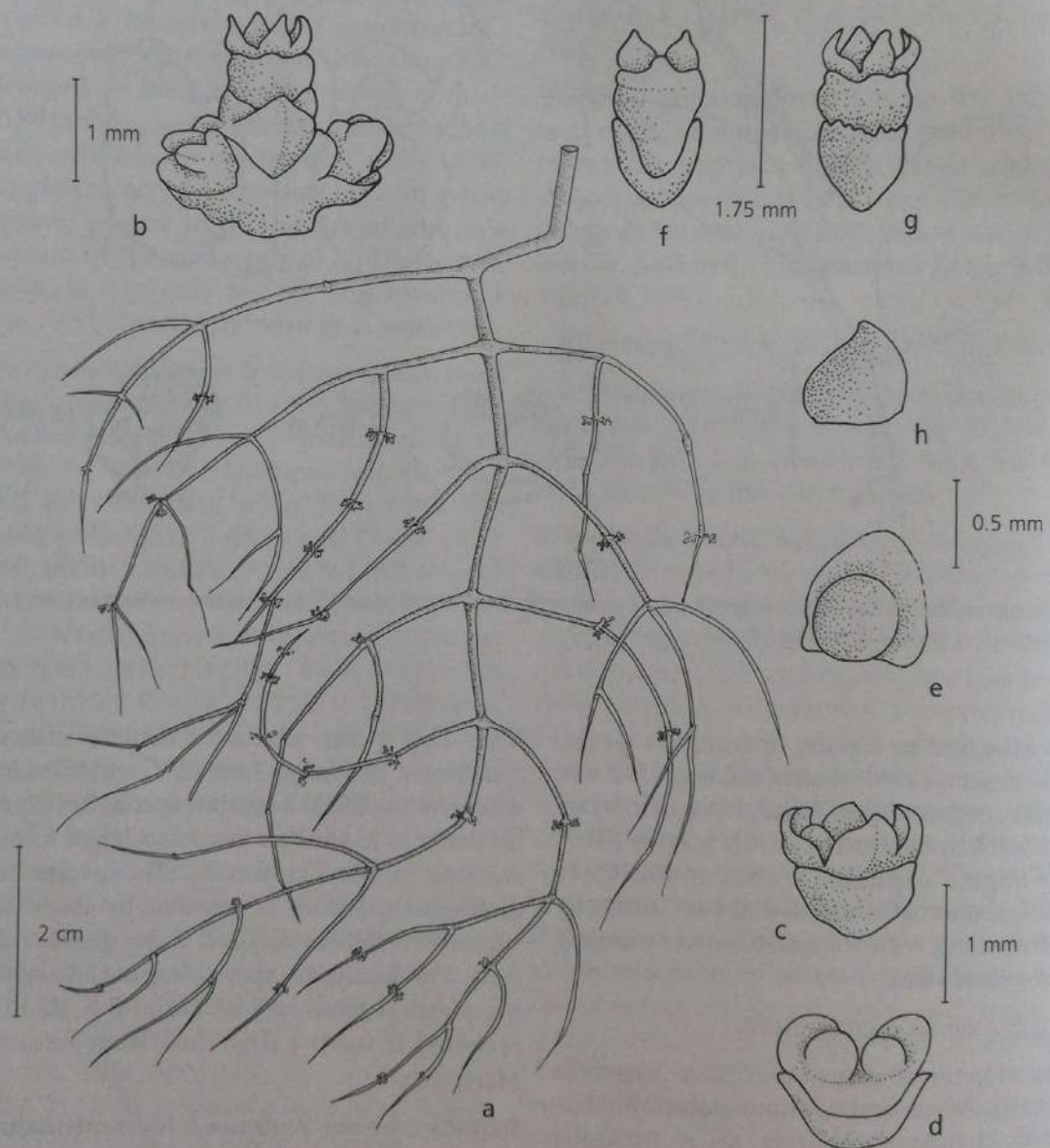


Figure 13. *Viscum ramosissimum* Roxb. ex DC. - a. Habit; b. Inflorescence; c. Male flower; d. Male flower, l. s.; e. Male perianth lobe with anther; f. Female flower; g. Female flower, l. s.; h. Female perianth lobe.

and more slender. *Leaves* generally absent; [the only leaf seen in Wallich's specimen (6876) is lanceolate-obovate, attenuate towards the base but not petiolate, rotund at apex, c. 2.2 x 0.5 cm, with distinct longitudinal nerves]. *Inflorescences* usually sessile and lateral but sometimes terminal, if so peduncled, 1-flowered or 3-flowered, if 1-flowered, female subtended by 2 bracts connate at base; if 3-flowered, the central one being female and the laterals male with individual bracts, sometimes adventitious cymes developing laterally to the first with a similar structure, making the total number of cymes at the node to 6, further additions not observed, the bracts in all cymes triangular, with broad base and acute apex, c. 0.75 x 0.75 mm. *Male flowers* more or less globose, compressed laterally with wedge-shaped base, c. 1x1 mm; perianth lobes 4, free, broadly ovate, acute at apex, bearing an anther on its inner surface, c. 0.75 x 0.5 mm; stamens 4, filaments absent, anthers sessile, round, attached to the perianth lobes on inner surface, c. 0.5 x 0.5 mm, opening by pores; pistillode absent. *Female flowers* oblong, c. 1.75 x 0.75 mm; perianth lobes 4, free, conical with short base, acute at apex, c. 0.5 x 0.25 mm; staminodes absent; ovary inferior, ovules not distinct; style short, slightly conical; stigma nipple-shaped. *Fruits* small, drupaceous, subglobose to globose, 3-4 mm in diameter, pale green.

Flowering & Fruiting: February-August.

Distribution: India (The Western Ghats of Maharashtra, Karnataka, Kerala and Tamil Nadu and Southern parts of Andhra Pradesh), Sri Lanka.

Hosts: *Erythroxylon monogynum* Roxb., *Zizyphus jujuba* Lam., *Z. nummularia*, *Rhus mysorensis* (Burm. f.) Wight & Arn., *Cassia montana* Roth, *Acacia sundra* (Roxb. ex Rottl.) Willd., *Santalum album* L., *Flueggea microcarpa* Blume and *F. leucopyrus* Willd.

Note: This species is very distinct from its allies *V. angulatum* and *V. articulatum* in having terete internodes. Besides Wallich's specimen, there is another specimen (Alphonse Amalraj 11025 in RHT) with leaves. Thus, this cannot be taken as a leafless species.

Specimens Examined: **Karnataka**, Mysore, 3000 ft., 5.7.1893, Talbot 3000 (CAL); Coorg, Mercara, Gamble 74627 (CAL). **Kerala**, Wyanad, Chundal, 1450 m, 22.8.1997, Sanjai 104942 (MH); Thiruvananthapuram, Bonoccord, 1200 m, 20.4.1994, Abdul Jaleel & Shanavaz Khan 16004 (TBGT). **Tamil Nadu**, Coimbatore, 1400 ft., 9.2.1910, Fischer 1734 (CAL); Anamalai hills, 4500 ft., 11.5.1912, Fischer 3418 (CAL); Tholanpalayam, 1400 ft., 10.1.1953, Vaid 23245 (DD); Mettupalayam,

17.5.1910, Barber 8547 (MH); Kollegal, 11.2.1924, Jacob 17327 (MH); Vellingiri, 666 m, 6.3.1957, Sebastine 2487 (MH); Salem, Thumbal, 1000 m, 19.7.1977, Ansari 49914 (MH); Attur, Chinnakal ranges, Thumbal extension R.F., 500 m, 9.1.1978, Alphonse Amalraj 11025 (RHT); Woddapatti R.F., 300 m, 18.7.1964, Vajravelu 20704 (MH); river bank, Hoganaikkal, 275 m, 11.3.1965, Vajravelu 23527 (MH); Tiruchirapalli, foot of Pachamalai hills, 333 m, 18.3.1959, Sebastine 7886 (MH); Ramanathapuram, Cumummedu, 1025 m, 14.3.1970, Vajravelu 33746 (MH); Tirunelveli, Tiger falls, Manimuthar, 333 m, 11.10.1957, Sebastine 4370 (MH); Mundanthurai, 14.5.1901, Barber 2785 (MH); Kalakkad R.F., 275 m, 7.3.1963, Joseph 15810 (MH); Kanniyakumari, way to Sengammal estate, 500 m, 27.7.1966, Shetty 27998 (MH).

Viscum subracemosum Sanjai & N.P. Balakr. in *Rheedea* 10(2): 113, f. 1. 2000.

Type: India, Karnataka, Krishnarajapuram, 900 m, 20.10.1995, Sanjai 104912 (Holotype, CAL; Isotypes, MH).

Semi-parasitic herbs, monoecious, evergreen, up to 75 cm long, dichotomously or trichotomously branched; branches slender, dark green in colour, lower internodes terete, c. 3-5 x 0.2-0.4 cm; upper internodes slender and longitudinally grooved, c. 5-7 x 0.1-0.2 cm; nodes swollen. *Leaves* opposite, broadly lanceolate, nerved, c. 3-6 x 1.5-2.5 cm, tapering towards base, rounded at apex, with 3 veins, more distinct above than below. *Inflorescences* distinctly subracemose, rarely cymose, pedunculate, laterals arising from the axils of the leaves at nodes, up to 6 at each node; flowers enclosed in a cupule formed out of 2 connate acute bracts; bracts c. 1 x 1 mm, broadly ovate, caudate at base and acute at apex; flowers usually 5 in a group, very rarely 3, the central flower female and laterals male; at times all-female-inflorescences also noticed. *Male flowers* sessile, subglobose, c. 1.5 x 1 mm; perianth lobes 4, free, of two types, the larger ones two, c. 1 x 0.75 mm, ovate, acute at apex, oppositely placed, bearing an anther each on the inner surface, ovate, acute at apex, c. 1 x 0.75 mm, the smaller ones two, opposite, acuminate at apex, c. 1 x 0.5 mm; stamens 2, filaments absent; anthers 2, sessile, attached to the inner surface of the larger perianth lobes, dehiscence by means of pores; pistillode absent. *Female flowers* oblong, c. 2 x 1 mm; perianth lobes 4, free, valvate, broadly ovate, acute at apex, c. 1 x 0.5 mm; staminodes absent; ovary inferior, ovules not distinct; style short; stigma nipple-shaped. *Fruit* a berry, globose, smooth, up to 5 mm in diameter.

Flowering & Fruiting: January-September.

Distribution: India (Tamil Nadu, Karnataka), endemic.

Host: Pongamia glabra Vent. Heavy parasitisation of the host is noticed at various places.

This species is allied to *V. acaciae* but differs in the following characters:

<i>Viscum acaciae</i>	<i>V. subracemosum</i>
Inflorescence generally cymose, only rarely subracemose	Inflorescence distinctly subracemose, only rarely cymose
All-female-flowered inflorescences absent	All-female-flowered inflorescences present
Usually 3 flowers in a group, rarely more	Usually 5 flowers in a group, rarely less
Female flowers large, c. 3 x 1 mm	Female flowers small, c. 2 x 1 mm
Male flowers oblong, c. 1.5 x 0.5 mm	Male flowers subglobose, 1.5 x 1 mm
Fruits oblong	Fruits globose

Specimens Examined: **Karnataka**, Krishnarajapuram, 900 m, near the ITI gate on *Pongamia glabra*, 20.10.1995, *Sanjai* 104912 (CAL, MH). **Tamil Nadu**, Coimbatore, TNAU campus, 260m, in front of the canteen on *Pongamia glabra*, 3.6.1997, *Sanjai* 104936 (MH).

Viscum trilobatum Talbot, For. Fl. Bombay 2: 419, t. 479. 1911; Danser in *Blumea* 4: 308, t. 3 A & B. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 163. 1957.

Type: North Canara, Talbot s. n. (DD!)

Viscum capitellatum auct. non Sm.: Hook.f., Fl. Brit. India 5: 225. 1886, p. p.; T. Cooke, Fl. Pres. Bombay 2: 552. 1906, p. p.; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925, p. p.;

Semi-parasitic herbs, evergreen, monoecious, erect, up to 25 cm long, decussately branched below and dichotomously branched towards the upper portions; internodes terete at base, slightly stripped or angular upwards, up to 8 cm long and up to 4 mm in diameter; nodes swollen. *Leaves* normal, opposite, sessile or subsessile, obovate or suborbicular, slightly wavy along margins, c. 0.75-2 x 0.5 x 1.5 cm, coriaceous; main nerves 3, distinct above; petioles up to 2 mm long. *Inflorescence* cymose, shortly peduncled, mainly axillary at nodes, but rarely terminal, up to 6 at each node; peduncles short, up to 5 mm long, bearing a boat-shaped cup of 2 connate bracts enclosing 3 sessile flowers, the central one being large and male, the laterals female, rarely all the flowers female, at times very rarely instead of the central flower, another peduncle with a similar set of flowers arise. *Male*

flowers sessile, pandurate, c. 2.5 x 1.5 mm; perianth lobes 3, free, valvate, triangular in shape, c. 1.5 x 1.5 mm; stamens 3, sessile; anthers 2-loculed, attached to and placed opposite to the perianth lobes on the inner side; pistillode absent. *Female flowers* sessile, oblong, compressed towards the base, c. 2 x 1 mm; perianth lobes 4, free, valvate, erect, c. 0.75 x 1 mm; staminodes absent; ovary inferior, ovules not distinct; style short and stigma capitate. *Fruit* a drupe, nearly rounded or ovoid, smooth but with some ridges, c. 5 x 4 mm.

Flowering & Fruiting: February to June.

Distribution: India (Karnataka, Kerala, Tamil Nadu), endemic.

Hosts: *Dendrophthoe falcata* (L. f.) Ett., *Loranthus bracteatus* Wall., *L. tomentosus* Roth and *Excoecaria agallocha* L.

Note: We found this species exclusively hyper-parasitic.

Specimens Examined: **Karnataka**, Without locality, 1888, Talbot 1619 (CAL). **Kerala**, Thiruvananthapuram, before Bonoccord tea estate on roadside, 900 m, 28.4.1996, *Sanjai* 104924 (MH); Wyanad, Kallur, 1500 m, 22.8.1997, *Sanjai* 104940 (MH); Malabar, 24.12.1907, *Fischer* 329/1178 (DD). **Maharashtra**, Siddapur, 10.1.1896, Talbot 3739 (CAL). **Tamil Nadu**, Nilgiri, Devarshola, 1200 m, 19.1.1961, *Shetty* 11934 (MH); Bokokapuram R.F., 1100 m, 12.8.1970, *Sharma* 35430 (MH); ibid. 1050 m, 19.2.1972, *Sharma* 39861 (MH); ibid. 3000 ft., Nov. 1884, *Gamble* 15693 (CAL); Coimbatore, Jirgan halli, 3000 ft., 24.9.1906, *Fischer* 1020 (DD).

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V. N. Sanjai and N. P. Balakrishnan 109

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Index

Synonyms are in italics. Page number in bold indicates a figure in the text.

Arceuthobium M. Bieb.	78	<i>confertum</i> Roxb.	98
minutissimum Hook. f.	78,79	<i>costatum</i> Gamble	85
oxycedri (DC.)M. Bieb	79	<i>dichotomum</i> Bertero ex Spreng.	90
<i>Aspidixia ramossissima</i> (Wall. ex DC.)		<i>falcatum</i> Wall. ex DC.	97
van Tiegh.	104	heyneanum DC.	94, 95
<i>Bifaria japonica</i> (Thunb.)van Tiegh.	81	var. <i>liocarpum</i> Danser	94
<i>Bifaria coralloides</i> (Wight) van Tiegh	81	<i>japonicum</i> Thunb.	81
Ginallia Korth.	80	<i>liquidambaricolum</i> Hayata.	90
andamanica Kurz	80	loranthi Elmer	96
<i>arnottiana</i> Korth	80	malurianum Sanjai & N. P. Balakr.	97
Korthalsella Van Tiegh	81	<i>moniliforme</i> Wight & Arn.	81
japonica (Thunb.)Engler	81,82	var. <i>coralloides</i> Wight	97
var. <i>coralloides</i> (Wight)van Tiegh	81	monoicum Roxb.	99
<i>opuntia</i> (Thunb.)Merr	81	mysorensis Gamble	90
<i>remyana</i> Van Tiegh	83	<i>nepalense</i> Spreng.	90
Viscum L.	85, 86	var. <i>thelocarpum</i> Danser	81
acaciae Danser	83, 85, 86, 87	<i>opuntia</i> Thunb.	90
album L.	90	<i>opuntioides</i> Roxb.	94
<i>amuseo</i> Lamber.	85	<i>orbiculatum</i> Wight	94, 98, 100,101, 102
var. <i>meridianum</i> Danser	88, 89	<i>orientale</i> Willd.	96
angulatum Heyne ex DC.	83, 90, 91	<i>osmastonii</i> Raizada	102, 103
articulatum Burm. f.	90	<i>ovalifolium</i> Wall. ex DC.	79
var. <i>dichotoma</i> Kurz	90	<i>oxycedri</i> DC.	88, 97, 104
<i>attenuatum</i> DC.	98	<i>ramossissimum</i> Roxb. ex DC.	105
<i>benghalense</i> Roxb. ex Wight & Arn.	92, 93, 106	<i>subracemosum</i> Sanjai & N. P. Balakr.	106
<i>capitellatum</i> Sm.		<i>trilobatum</i> Talbot	94, 100
		<i>verruculosum</i> Wight	100
		<i>verticillatum</i> Roxb.	